THE JOURNAL OF INDUSTRIAL ECONOMICS

Volume IV
1955-6

BASIL BLACKWELL
OXFORD

BOARD OF EDITORS

P. W. S. ANDREWS (General Editor): Official Fellow of Nuffield College, Oxford.

PROFESSOR CHARLES F. CARTER: Professor of Applied Economics, The Queen's University of Belfast, Northern Ireland.

PROFESSOR JOEL DEAN: Professor of Business Economics, Columbia University, and Partner, Joel Dean Associates.

PROFESSOR P. SARGANT FLORENCE: Professor of Commerce, University of Birmingham.

PROFESSOR R. B. HEFLEBOWER: Professor of Economics, Northwestern University.

PROFESSOR E. S. MASON: Dean, Graduate School of Public Administration and Professor of Economics, Harvard University.

Secretary and Editorial Assistant: ELIZABETH BRUNNER.

MONOPOLY INVESTIGATION AND METHODS FOR CALCULATING THE RATE OF RETURN ON CAPITAL EMPLOYED

by I. P. Andren

I: NATURE OF THE PROBLEM

The Monopolies Commission's report on the Match Industry was published in May, 1953. It was apparent that a part with which we in the Industry were not in agreement was that dealing with profits. The Commission, it appeared, placed some reliance on the use of historical values, whereas the Industry considered this method misleading. This led the writer to examine also the Commission's other reports, particularly that on Electric Lamps, in an endeavour to find the explanation for this divergence of views. This article was the result.

In Sections 1 and 2 the general principles and implications of using historical cost figures for such purposes are examined; in Sections 3 and 4 a method of comparison between rates of return on current and historical values is suggested.

Paragraph 14 of the Monoplies and Restrictive Practices (Inquiry and Control) Act, 1948, gives guidance to the Commission on the lines of investigation to be pursued. It reads:

> In determining whether any conditions to which this Act applies or any things which are done by the parties concerned as a result of, or for the purpose of preserving, any conditions to which this Act applies, operate or may be expected to operate against the public interest, all matters which appear in the particular circumstances to be relevant shall be taken into account and, amongst other things, regard shall be had to the need, consistently with the general economic position of the United Kingdom, to achieve —
>
> (*a*) the production, treatment and distribution by the most efficient and economical means of goods of such types and qualities, in such volume and at such prices as will best meet the requirements of home and overseas markets;
>
> (*b*) the organization of industry and trade in such a way that their efficiency is progressively increased and new enterprise is encouraged;
>
> (*c*) the fullest use and best distribution of men, materials and industrial capacity in the United Kingdom; and
>
> (*d*) the development of technical improvements and the expansion of existing markets and the opening up of new markets.

This clearly implies that after full examination the Commission

is expected to give (inter alia) a reasoned opinion whether, as a result of restrictive practices, prices charged to the consumer are or may be unduly high — truly a difficult task under any circumstances. It may also be useful to draw attention to a second point — whether new enterprise is encouraged. As we shall see later, these two questions must be regarded as complementary.

With the further main points of Para. 14 covering questions of efficiency and the opening up of new markets, this article is not directly concerned.

The intention of the instruction to the Commission is evident. It is not, however, clear from the published reports whether the Commission has been satisfied or not with the basis of comparison adopted, that is, a rate of return on capital employed, based on historical costs. This is unfortunate, as the Commission's views on this point might have added much to the value of the Price and Profit sections of the various reports.

As a starting point, it appears that the underlying object of the Commission has been to assess whether prices or rates of profit have been similar or less favourable to the consumer than those that would have obtained in a state of free unfettered competition. In the Reports themselves the Commission concentrates on two methods of assessing profits. Firstly, profits are expressed as a percentage of net sales; secondly, as a return on the capital employed, the latter method applying particularly to the Reports on Electric Lamps and Matches. There can be, of course, no objection to either method as such, but it may well be asked whether the data available was adequate for the purpose.

As an example, the figures for net profit percentages on sales given for Electric Lamps may be examined. (Page 72, para. 205). This table shows a variation in weighted average percentages from 30.7 and 28.2 for ELMA concerns in 1937-38, to 17.2 and 21.2 for independent manufacturers. The 1947-48 figures are from 16.0 to 7.9 for the ELMA concerns and from 6.0 to 1.8 for the independents. The more interesting feature of this table is not, it is suggested, these average percentages but the percentages listed for the individual concerns. Thus, in 1938, the percentage for ELMA concerns varied from 0-34 per cent and for the individual concerns 2-39 per cent, and similar large variations occur for the other years. In view of these large variations from firm to firm the value of this method of comparison must appear to be in doubt. Seeing the profit figures used are the total for all types of lamps, may the figures not be affected more by the types of lamps made, as is understandable, rather than by actual differences between the firms?

In cost accounting the basis chosen for spreading factory overheads is often materials plus labour or labour only when, for instance, the variety of products produced on the same machinery makes the first method unsuitable. Clearly the method chosen must allow for factory overheads to be properly covered, no matter how the production programme varies from time to time in the factory concerned. The possibility of usefully comparing the percentage of net profit on sales is open to similar considerations. Thus, concerns marking up net sales with a constant percentage of profit could find total profits varying widely, even from month to month, according to the group of articles currently manufactured. These could well contain a larger or smaller element of purchased materials or components but involve roughly the same manufacturing and selling outlay. Again, comparison between one firm and another must be quite misleading if rates of turnover vary. Goods that are turned over very rapidly with a small percentage profit margin can produce a very large profit on capital employed and vice versa. It is not necessary to elaborate this point further to indicate the drawbacks of this method of profit comparison.

This difficulty in obtaining a particular percentage of net profit on sales which could be regarded as 'reasonable' no doubt led the Commission to rely mainly on its second method of expressing profits, that is, as a percentage of capital employed. There can be no doubt that, at least as far as manufacturing industries are concerned, this must be the best approach. The real question, therefore, is not whether such a yardstick is correct or incorrect in principle, but whether sufficient statistical data can be obtained to substantiate the usefulness of such figures as are prepared.[1]

Two criteria can be suggested for a satisfactory basis for assessing profits as a percentage of 'capital employed'.

In the first place, the method used should be such as to give a fair comparison between one firm and another or one industry and another. This can best be discussed by assuming roughly pre-war conditions, that is, a period of fairly constant price levels, the book or historical cost of fixed assets less depreciation reserves being the

[1] Ref. 'The Need for a Definition of Capital Employed for use in Measuring Remuneration Earned', by C. L. Parker, *The Journal of Industrial Economics*, April 1955.

In this instructive article Mr. Parker sets out the methods used to arrive at a profit formula for Government contracts. He points out that, in order to establish a price that is acceptable as 'fair', it is necessary to ascertain:

(*a*) the cost of manufacture, including all appropriate overheads;
(*b*) the contractor's total sales turnover; and
(*c*) the contractor's total 'capital employed'.

He comments: 'The frequent references to "capital employed" in Government reports suggests that the meaning of this phrase is clear and unequivocal when, in fact, it is a term used very loosely by accountants examining a set of accounts.'

same as current values, material prices and labour rates remaining unchanged.

In the second place, a method requires to be found to adjust figures to take account of inflationary changes as reflected in wide divergencies between book values, that is, historical values, and current values. As will be shown later, it is above all the inflation of recent years that makes the yardstick used by the Monopolies Commission so difficult to interpret.

Conditions of Stable Prices. Over a period of relatively stable prices a direct comparison of the rate of profit (in relation to capital employed) of one industry with industry in general, could serve a useful purpose. There is no reason why such an average rate of profit for industry need be identical with a rate of profit earned under purely competitive conditions, but it can be expected to approximate to such a rate and as such offers a useful yardstick.

For competition solely to determine the rate of profit the economist would have to assume that industry consists of a large number of small units each competing actively with the other and no unit is sufficiently large to influence selling prices by its own actions. The more rapid growth of one unit than another, either at the expense of other undertakings or in its share of a growing market, then depends on its relative efficiency. The rate of profit earned likewise reflects a rate of return on the capital employed that is sufficient to attract new investment into the growing unit or industry.[2] On these assumptions it would have been open to the Commission, when investigating a monopoly, to compare the rate of return on capital employed directly with the rate of return being earned in industry in general.

If the Commission's investigations had been made against such a background of stable prices, then after comparing the profits of the monopoly concerned with industry in general, a further consideration would remain. The Commission would require to judge whether the industry concerned involved either a greater or less amount of risk than the average[3] and consequently whether a profit above or below the average for industry in general would be 'reasonable' in competitive conditions.

Although an exact judgment on such points could not be expected,

[2] Under competitive conditions an average rate is, as it were, the middle step in a long ladder of different rates of profits being earned in that industry by different units, a proportion of units being well below the average. A rate above that average would be quite consistent with greater efficiency and therefore profits above the average, since competition would be ensured by new units entering the industry as the less efficient ones fell out.

[3] See Knight – *Risk, Uncertainty and Profit* – 'risk' has a wide definition in this connection.

any great variation after making allowances for this would provide a strong prima facie case that restrictive practices had resulted in inflated profits and prices against the consumer's interest.

It may be pointed out that this latter task is, in practice, no different from the daily business of the financial houses engaged in the issue of new shares. The rate of return attractive to the new investor must in each case be assessed in relation to the 'risk' factor of the industry concerned. The task of assessing a fair return for nationalized industries is also basically the same although financial results often appear to take second place to immediate political convenience.

These well-known considerations have been referred to at some length. Although it is primarily the working of inflationary factors that makes rates of profit so difficult to interpret today, these are the basic principles of the comparison with industry in general that must be borne in mind.

II: PROFITS AND THE HISTORIC COST ERROR

The controversy as to whether profits as measured for taxation purposes should provide for the recovery of the original money cost assets used in the business, or for the recovery of their current replacement cost, is one on which sides need not be taken for this purpose. Even if it were possible, which is doubtful, to say one concept is 'right', the correct choice must be to accept the concept which is 'serviceable'. (See 'Monopoly Investigation and the rate of return on capital employed', by A. Silberston and D. Solomons, *Economic Journal*, December 1952; also W. T. Baxter, *Westminster Bank Review*, May 1952, 'Inflation and Accounting Profits'.)

During inflationary conditions, assets such as stocks and plant have proved almost as defenceless as money costs.

If it is accepted that current replacement cost is the serviceable basis for inclusion in the amount of capital employed, it is clear that depreciation must also be calculated on the same basis.

A parallel argument applies to trading stocks. In arriving at profits, stocks must then be valued in times of inflation on a LIFO basis, so that rises in the value of stocks reflect broadly physical increases only. Only by recalculation of trading stocks on a basis of current values can a worth-while comparison of profits be made.

Suppose the Monopolies Commission decided in principle to use current values as the basis for their assessment of capital employed. The next stage, i.e. to find a basis of comparison, is then far from easy. Unfortunately Company accounts in general contain no information on the rate of profit being currently earned in industry

on the real capital employed. With isolated exceptions, companies do not supplement their financial figures with statements of account indicating current as well as historical values of assets. (The Unilever accounts are an interesting example of explanatory accounting methods. Trading profits increased from £25m in 1946 to £54m in 1951, but at the same time total capital employed rose almost entirely through inflationary factors from £193m to £358m. It is then calculated that the profit in relation to ordinary shareholders' funds was 5.4 per cent in 1946 and 7.6 per cent in 1951. With ordinary accounting methods the relation of the figure for trading profit, which had doubled, to that for capital employed would be a matter of pure guesswork.)

The lack of information means that, to obtain even rough figures for industry in general, it becomes necessary to take historical values as shown in company accounts as a basis and to write these up by suitable index numbers to reflect current values. Although such a method may not give any great degree of accuracy it may well be sufficient for the purpose, seeing that in recent years various investigations on the subject have been made by the FBI and other bodies and, in fact, the use of such index numbers by industry for their own purposes is becoming more and more widespread. When an industry is under investigation, since the result is so essential to the interpretation of the statistics used by the Commission, its staff should make the attempt to provide the index figure required. It is on this assumption that the examples given in the last section of this article have been prepared.

Taking current values as the basis, and with adjustment of profits for depreciation as indicated above, it is suggested that a fair approach for assessing 'reasonable profits' could be made on two separate lines, each method in effect confirming the results of the other. These lines of approach are:

(*a*) To compare like with like and to demonstrate whether the concerns in question are earning a higher rate of profit on capital employed than is the case in general for other industries subject to a similar risk factor.

(*b*) To relate the rate of profit on capital employed in the concerns to a hypothetical rate (to be determined) that would be required to attract new entrants into the industry.

That these methods of approach are basically correct can be seen by reference to the instructions given in Para. 14 of the Monopolies Act, cited previously. Under (*c*) this paragraph states expressly that the Commission should have regard to 'the fullest use and best

distribution of men, materials and industrial capacity in the United Kingdom' and under (*b*) 'the organization of industry and trade in such a way that their efficiency is progressively increased and *new enterprise is encouraged*' (author's ital.).

If, as a result of restrictive practices, the industry is seen to be able to maintain a profit level above that which can be earned in industry in general where the same risk factor exists, it is evident that not only are the prices to the consumer high but that capital may not be directed for further investment in the manner that would best serve the country's interest. On the other hand, if the Commission, as a result of its investigations, should make a mistake and assess a 'reasonable' level of profits incorrectly and, for example, recommend a strict form of price control and an unduly low rate of profit on capital employed, the resulting loss of profits must in time cause capital to disappear from an industry in which it could earn a fair return. This effect of a strict price control is not, however, so immediately dangerous as the effect both on the remaining competitors in the industry and on the possible new entrants. The Commission is instructed to make recommendations that, in total, will encourage new enterprise. Such measures as they recommend to counteract and abolish previous types of restrictive practices must all fail to encourage new enterprise if, at the same time, the method of price control adopted makes it impossible for new enterprise to earn a 'reasonable' level of profits.

Defined on these lines, the Commission's task is seen to be very different from that of the war-time price control authorities. It would be generally accepted that price control was essential at that time. War involved a scarcity of all resources, not only materials but also manpower. Once an allocation system was in being it necessarily followed that in many fields price control had to be introduced to hold inflation in check, and to prevent a misuse of resources. There was no question of encouraging new competition.

In the section which follows some suggested formulas are shown, setting out these two methods of approach in accountancy terms.

III: SUGGESTED METHODS OF CALCULATING RATE OF PROFIT ON CAPITAL EMPLOYED

In order to arrive at current values for capital employed, it is necessary to analyse the total into its three main constituent parts, i.e. land and buildings, plant and machinery, and working capital. It is clear that for a given industry the ratio between current values and historical values can vary on two counts. Firstly, there is the question of the time factor, i.e. the relative age of the assets. Secondly,

there is the question of the proportion of working capital to total capital employed, which may vary considerably. In Table I, industry 'A' has been taken to have working capital equivalent to 45 per cent of total capital employed, and industry 'B' 60 per cent. In columns 'A1' and 'A2' the historical values are re-calculated to provide for alternative estimates of current values at twice, and three and four times the historical values.

TABLE I

CAPITAL EMPLOYED, CURRENT AND HISTORICAL COSTS

Industry A – Historical costs (land and buildings 25%, plant 30%, working capital 45%)

Industry B – „ „ (land and buildings 15%, plant 25%, working capital 60%)

	Historical Costs	*A1 Current Values*	*A2 Current Values*
Industry A			
Land and Buildings	25	50 (2)	100 (4)
Plant and Machinery	30	60 (2)	90 (3)
Working Capital	45	45	45
	100	155	235
Industry B		*B1*	*B2*
Land and Buildings	15	30 (2)	60 (4)
Plant and Machinery	25	50 (2)	75 (3)
Working Capital	60	60	60
	100	140	195

It will be seen from this example that, according to the various assumptions, current values vary from 140 per cent of historical values in B1 to 235 per cent under A2.

It may be mentioned in this connection that, from investigations made by the FBI, it would appear that a common index number to relate current values of fixed assets to historical values for industry in general was of the order of 200 per cent-250 per cent in 1950, i.e. rather above the figures of columns A1 and B1, but below A2 and B2 which might be taken to represent an old-established concern that has carried out little or no rebuilding since the war. (See Philip Redfern's paper read to the Royal Statistical Society, January, 1955 – 'Net Investment on Fixed Assets in the United Kingdom 1938-53'. The figures given, he says, 'suggest that, for a considerable range of plant and machinery, depreciation at current replacement cost in the years 1948-52 was nearly twice the depreciation at original cost'. The indices given in Mr. Redfern's paper show plant and machinery at 1925/35 – 36-38; 1950/52 – 109-135; or roughly three times, and for buildings very similar ratios.)

TABLE II

RATES OF PROFIT AND CAPITAL EMPLOYED

Industry A – Based on historical and current values from Table I

A. Historical Values Capital Employed £100				*A1. Current Values* Capital Emp. £155			*A2. Current Values* Capital Emp. £235		
Trading Profit	22%								
Retained	60%								
		£	%		£	%		£	%
Gross Trading Profit		25			25			25	
Less:									
Depreciation allowed tax		3.0			3.0			3.0	
		22.0	22%		22.0	14.2%		22.0	9.4%
Less:									
I. Tax	10.0			10.0			10.0		
P. Tax	2.0	12.0		2.0	12.0		2.0	12.0	
		10.0			10.0			10.0	
Retained (60%)		6.0			6.0			6.0	
Dividends Tax Tree (40%)		4.0			4.0			4.0	
Equivalent to gross dividend on capital employed		7.3	7.3%		7.3	4.7%		7.3	3.0%

The next stage in Table II is to express trading profit as a percentage of capital employed. For this purpose, dealing with industry 'A' only, a gross trading profit on historical values of 25 per cent has been chosen. It is believed that this percentage of earnings is fairly representative of actual industrial earnings in 1948-52, and it has in fact been based on the summaries of company reports shown in *The Economist* Quarterly Surveys. In arriving at the 25 per cent the figure for capital employed used has been subject to deduction of reserves for depreciation and obsolescence from the fixed assets, and does not include investment items shown in a company's balance sheets, i.e. gilt-edged etc., or any items for goodwill or intangible assets. This should correspond fairly closely to the formula adopted by the Monoplies Commission. The profit figures shown give a ratio of dividends after tax to amounts retained as reserves of 40/60. (It is not claimed that this is any more than an intelligent guess but inaccuracy on this point need not affect the general conclusions). In the following columns A1 and A2, these profit figures are reassessed as a percentage of the capital employed on a current value basis.

Following these calculations, it will be seen that, after adjustment for capital employed in A1, trading profit after depreciation becomes 14.2 per cent instead of 22 per cent and dividends 4.7 per cent

instead of 7.3 per cent. Similarly, in example 'A2' the trading profit is reduced to 9.4 per cent and dividends to 3.0 per cent.

It is unnecessary to give further examples to show the important variations in rates of profit that are to be expected when industries vary so widely in the ratio of current values to historical values. As is well-known, certain industries, such as the shipping companies, are particularly badly hit by inflation, as not only has current replacement cost increased many times over pre-war costs, but the ships themselves have a limited life and consequently annual depreciation must be at an exceptionally high rate. Depreciation rates for plant and machinery may themselves vary from, say, 5 per cent for items with a long life, up to 15 per cent or 20 per cent for such items as vehicles etc. This again shows that a comparison between industries or between one firm and another based on historical costs without adjustment must be valueless. For a comparison of rates of profit to be made, the capital employed must in some way be assessed on a basis of current values.

Table II shows only a partial story of the allocation of profits, in that it provides no guidance as to the proportion of the profits retained that represents a net saving by industry: in other words, which part of reserves must be earmarked either for the higher depreciation required on replacement values, or as reserves against a change in stock values.

TABLE III

INDUSTRY 'A' (HISTORICAL VALUES) COMPARED WITH NEW INVESTMENT UNDER A1 AND A2 CURRENT VALUES

	A1 *Current Values* Capital Employed £155 Dividend 8% gross Retained 1/3rd	£	%	*A2* *Current Values* Capital Employed £235 Dividend 8% gross Retained 1/3rd	£	%
	Gross Trading Profit	29.5			46.0	
	Less:					
	Depreciation	5.5			9.5	
		24.0	15.5%		36.5	15.5%
	Income Tax plus basic profits tax	11.4			17.3	
	Dividend 8% less income tax	6.75	8.0% (gross)		10.3	8.0% (gross)
	Distribution tax thereon	2.5			3.8	
		20.65			31.4	
	Balance retained	3.35			5.1	
		24.0			36.5	

Note: Gross trading profit as percentage of capital employed in 'A' (£100) is 29.5% for A1 and 46.0% for A2.

As will be seen from the depreciation figures in Table III, under the A1 conditions nearly half of the profits retained 6.0 (see Table II) is required for added depreciation (i.e. depreciation 5.5 of which 3.0 allowed for tax) and under the A2 conditions the 6.0 is insufficient for this purpose (i.e. depreciation 9.5 of which 3.0 allowed tax).

In Table III the alternative approach is illustrated by re-analysing the profit figures under A1 and A2 conditions on the lines on which they would be included in the prospectus of a new industrial undertaking. As a basis for calculation, issued capital is taken at £155 and £235 as in Table I, and a dividend of 8 per cent has been chosen arbitrarily to represent a 'reasonable' rate of return sufficient to attract new capital for investment. It has further been assumed that, again to attract new investment, an amount must be earmarked for reserves equivalent to 50 per cent of the dividend after tax. Such assessments are not a theoretical concept, but must in fact be made in industry whenever a new undertaking is envisaged. Commencing with these assumptions, the level of profit can then be calculated which would enable the new company to attain these figures.

At first sight, the trading profit figures thus derived are somewhat surprising. It will be seen that, even for industry A1, a gross trading profit of 29.5 per cent instead of 25.0 per cent is required, whereas for A2 the figure is no less than 46 per cent. (Profits being expressed as percentages of capital employed (£100) as per Balance Sheet, i.e. historical values).

These results demonstrate clearly the value of including current values in such calculations. In spite of the wide variation in the apparent earnings under A1 and A2 conditions, the real rate of profit is, in fact, comparable in the two cases.

If the Monopolies Commission is to be expected to assess 'reasonable profits', this or some similar method of approach should certainly be seriously considered in each case.

IV: REPORTS ON ELECTRIC LAMPS AND MATCHES

The tables on the page following were published in the Reports.

Electric Lamps. Regarded in conjunction with Tables II and III, it is surprising to find that 1948 average profits for ELMA members at 7.7 per cent was so far below the 22 per cent estimated as an average for industry in general. It is to be noted that the industry stated replacement values of fixed assets were 2½ times current values. It follows that the apparent difference also reflects a real difference that would have been found if profits could have been related to capital employed expressed in terms of current values.

Electric Lamps (page 73):

TABLE IV

NET PROFIT PERCENTAGES ON CAPITAL EMPLOYED

Weighted Average Percentages

Year	*Number of Manufacturers*	*ELMA Concerns*	*Controlled Companies*	*Independent Manufacturers*	*Percentages for Individual Concerns*
1938	7	28.6			0, 8, 23, 31, 32
	3		21.2		−2, 13, 30
	3			23.7	8, 10, 30
1948	11	7.7			−10, 2, 5, 10, 10, 11 20, 23
	4		9.1		4, 7, 15, 23
	7			4.3	−8, 2, 5, 14, 25, 57, 156

Note: The method of computation was disputed by the ELMA members on the grounds that

(i) it took no account of the necessity to provide for replacement of fixed assets at current prices estimated to be approximately 2½ times original cost;

(ii) the allowance for wear and tear does not allow sufficient measure of depreciation. They have not, however, put forward an alternative computation.

Matches (page 71):

TABLE V

RATES OF PROFIT ON CAPITAL EMPLOYED

Manufacturer		*Commission's computation (Tables IV to VI)*	*British Match Corporation computations* (i) *Reinstatement as new at current prices without deducting depreciation*	(ii) *Original cost without deducting depreciation*
		%	%	%
Brymay	1949	22	9	15
	1950	17	6	11
Moreland	1949	51	31	33
	1950	46	23	30
Masters	1949	51	18	34
	1950	51	15	33

The table covers two concerns earning 20 per cent and 23 per cent respectively. With these exceptions, it is apparent that the rate of profit was well below the level at which new competition could be expected to thrive.

As regards ELMA's price policy, the account given to the Commission of post-war price reductions is interesting in this connection. (Page 71): 'The retail price [filament lamps] was again reduced in June 1949 from 1s. 3d. to 1s. 1d. ELMA has said that the motive for this reduction was "political", in the sense that it was intended to meet public opinion which was felt to be hostile at that time because of criticism — in ELMA's opinion unfair criticism — publicly directly against ELMA and its methods.'

The conclusions drawn by the Commission may also be quoted: (Para. 218): 'We conclude that while the prices charged for lamps

by ELMA members were unduly high in relation to costs before the war, the general level of their prices in 1948-49, and almost certainly in 1950, was moderate; the profit on general service filament lamps was small, that on discharge lamps very small, and that on motor and other lamps substantial.'

Perhaps it would not be unfair to assume that, with the above remark, the Commission was giving its blessing to the then level of profits as being 'reasonable'. Was this, in fact, a fair conclusion, or did the Commission's recommendation correspond to such a low level of profit as might drive the smaller and financially weak competitors out of business? Even if this were considered desirable at the time, from where are the stronger firms to obtain, in the long run, sufficient finance for re-equipment and modernization?

Matches. In comparing the report on Matches with the Electric Lamps, there is a fundamental difference to be borne in mind. Whereas ELMA represents a group of financially independent concerns the Match Industry is a combine. In this case, therefore, as far as profits are concerned, the industry should correctly be judged as a whole, larger profits in one unit being averaged out with lower profits in another. The industry has made this point in referring to differences in costs being due to a number of special reasons, among others, Brymay manufacturing types of matches not made by the other two concerns, and also carrying various items of central expenditure. In completion, therefore, of the table from the Report, a second table is inserted below, giving average profit figures for the British Match Corporation as a whole.

TABLE VI

RATES OF PROFIT ON CAPITAL EMPLOYED

Manufacturer		*Commission's Computation*	*British Match Corporation computations* (i) *Reinstatement as new at current prices without deducting depreciation*	(ii) *Original cost without deducting depreciation*
		%	%	%
B.M.C.	1949	32	14	21
Group	1950	26	10	18

For the years 1949-50 the average figures on the Commission's computation are then seen to be 32 per cent and 26 per cent, i.e. rather above the average figure of 22 per cent for industry in general. The conclusion of the Report (Para. 215) reads:

'the absence of competition . . . has resulted in profits and prices being higher than they would otherwise have been'. The Report recommends that price supervision 'should be a great deal stricter

than the price control which was exercised by the Board of Trade during and after the war'.

Commenting subsequently on the Report, the British Match Corporation has made various statements relating to profits in these years:

(i) To remain healthy an industry must be able to earn fair profits

(ii) That BMC does not agree with the Report that profits have been unduly high and states they are not high as compared with industry in general

(iii) By using historical costs as a yardstick and rejecting a fair assessment of working capital, the Commission have overstated the rate of profit earned.

These comments certainly appear to represent a considerable divergence in the views of the Commission and of the British Match Corporation. It may be interesting, therefore, to analyse on the lines of Table I the actual relationship between current and historical values in the three main match companies during the two years covered by the report (1949-50). The following picture then emerges:

Profit as a percentage of capital employed	1949	1950
Commission's figures for the three companies	32%	26%
British Match Corporation do.	14%	10%
i.e. capital employed taking fixed assets at current values (historical values being 100%)	228%	260%

The above percentages (228 per cent and 260 per cent) are clearly in the field of the A2 conditions set out in Table I rather than the A1 example which it is considered may be fairly representative for industry in general during the years concerned. It then follows that match profits, although at 32 per cent and 26 per cent apparently slightly above those for industry in general, were in fact, in real terms, well below the average.

It is not suggested that this in itself is a conclusive argument for judging what is a 'fair' level of profits. Other yardsticks than that of industry in general can be suggested; there is also, as mentioned earlier, the 'risk' factor to be assessed. It would seem, however, that over a long period, an industry must be able to earn profits approaching those of industry in general; otherwise finance will be lacking for replacements and new equipment and the industry will become moribund; the stronger the competition, the more quickly will the industry waste away.

The relationship between historical values and current values in a time of inflation has been discussed at considerable length above. To enable those approaching the problem from an accounting point of view to follow more readily the economic principles involved, various tables have been introduced as illustrations. The examples may appear to offer a clear basis of comparison. It should be stressed, however, that they are in fact illustrations only, and that the reader must bear in mind that the conceptions of an average rate of profit in industry cannot lend itself to exact statistical demonstration. From the limited information given in published company reports it is difficult to see how reliable tables could be prepared. This is, however, a fairly new field in accountancy and it may be, as more and more companies adopt the practice of including statements of current values as an explanation of their accounts, that a better understanding of the meaning of profits will be gained.

Such divergent conclusions as the above on both Electric Lamps and Matches must throw the strongest doubt on the methods used by the Monopolies Commission to judge whether the profits under consideration have been 'reasonable' or not. Until an alternative method can be devised that takes account of current values, it would seem that the profit sections of the Monopolies Commission's reports will be of very limited value.

LONDON

SOME FUNDAMENTAL PRINCIPLES OF A GENERAL THEORY OF MANAGEMENT

by J. L. MEIJ

Introduction.

On the occasion of the 40th anniversary of the Dutch School of Business Economics at Rotterdam, an International Management Congress was held, where (among others) Mr. A. F. L. Brech, Mr. Simpson and Professor E. Dale gave their view on the problem of finding an equilibrium between centralizing and decentralizing tendencies in the structure of management. The fact that the proceedings of the Congress, edited by H. J. Kruisinga, lecturer at the above mentioned school, have recently appeared, gives us an opportunity to review the question and to focus attention upon some general principles of organization and management.[1]

Those who came to the Congress to hear a solution of this problem will, I think, have returned more or less dissatisfied. An exact answer to the question how centralizing and decentralizing forces in management tend to an equilibrium was not given, nor was it made clear what sort of equilibrium of those forces is to be considered as the most satisfactory outcome.

It was not only the cloudiness of the results, however, that was dissatisfying. I for instance felt it a mistake that decentralization was often interpreted as delegation of authority and responsibility, or, as Dale put it, as delegation of decision-making power to lower levels. But it cannot be considered as a fact that this delegation means decentralization in managerial control. Delegation does not diminish nor even alter — as Brech asserted — the responsibility of the leaders at the top.[2] Strictly speaking we can only consider as constituting decentralization of managerial control those systems by which authority and responsibility are sub-divided among more leaders instead of being concentrated in one. This shifting from one concept to the other had consequences for both lectures and discussions.

The most important though modest result of the Congress therefore was in my opinion that it demonstrated the need for a theory of management. Until now the whole complex of management problems has usually been treated descriptively instead of analytically.

In the following sections I shall make some propositions about centralization and decentralization in management especially in relation to the question whether balancing these two can be

[1] *The Balance between Centralization and Decentralization in Managerial Control*, ed. by H. J. Kruisinga, Leiden, The Netherlands 1954 and Oxford 1955.

[2] A. F. L. Brech in: *The Balance between Centralization and Decentralization in Managerial Control*, op. cit., p. 18.

considered as the central problem in the theory of managerial control. Before doing this it may be helpful to consider some definitions of the terms which are most important in this field.

1. *Some definitions relating to the problem of centralization and decentralization in management.*

The problem of centralization and decentralization in management cannot be solved unless we have developed the principles on which all organization and management has to be based.

Unfortunately there are as many definitions of management as there are authors in this field. Perhaps we can do best by stating as Petersen and Plowman have done, that the concept has a twofold character. First, and in this we are considering the concept dynamically, we can define management as a process of exerting leadership over followers. In this way management is synonymous with managerial control. Second, however, management has a more structural and therefore static side tool. It is the creation of an organization 'logically and systematically devised to allocate authority, responsibility and accountability within a group'.[3]

We can consider this organization as the pattern according to which authority, responsibility and accountability are distributed. If we are reading this pattern from top to bottom, we see how authority and responsibility are delegated to lower and broader levels; following the opposite direction we see how both are concentrated on the higher and narrower levels.[4]

There seems little point in defining this concentration as centralization. There is always centralization in management notwithstanding the fact that authority and responsibility are delegated to lower levels. We may call the latter decentralization but then we cannot say that there is any alternative between decentralization and centralization. In this sense management is always centralized and decentralized at the same time: both centralization and decentralization are features of the outer structure of management. If so then the problem is not to find the balance between centralization and decentralization but to find the principle on which delegation rests.[5]

[3] Petersen and Plowman: *Business Organization and Management*, Chicago 1949 p. 36.

[4] It may be considered a misunderstanding to state as Kruisinga does that 'the management-process is at the same time centralized and decentralized. Decentralized in the delegation of decision-making power, centralized in the exercise of control over policies and activities . . .' Op. cit., p. 5. Centralization and decentralization is only the result of the direction in which one is peering at the management-pyramid.

[5] A. F. L. Brech is considering decentralization practically synonymous with delegation when he writes: 'Decentralization I am regarding as a state of organization to which specific responsibilities have been delegated.' Op. cit., p. 9.

However, another concept of decentralization seems possible. We can (as Dale expressed it) define decentralization as control by the few or the many in contrast with one-man control. In a theory of management both concepts will have their place. Nevertheless we cannot speak of balance between centralization and decentralization. What we can do, having a theory of management at our disposal, is to explain the conditions according to which, and to what limits, delegation is appropriate. In the same way we can try to formulate the conditions for control by one, by few or by many.

Our first objective, therefore, is the development of the basic principles of a theory of management. We will try to set out some of these underlying principles. Our reflections are not to be regarded as a presentation of a completely developed theory of management but only as an effort to demonstrate what in our opinion are the underlying principles of management-technique, in other words to give management-technique a somewhat more theoretical foundation. Doing this we may hope to be able to consider the measures and devices of which that technique consists, both as to their importance and as to their limitations.

As we intend to show in the following sections, the basic principle of all organization-structure is to be found in the concept of the scope of control, the sphere in which control is effective. We can consider this scope in two dimensions. First we can distinguish the span of control defined as the number of immediate subordinates for whom one leader can be responsible. In this definition control is only considered in its width, or, as we may say in a horizontal direction. We can nevertheless see the scope of control also in a second dimension, in its depth, the effectiveness of leadership from top to bottom. This may be called the vertical dimension of control.

In accordance with these two aspects or dimensions of the scope of control we can speak by analogy with the practice of business-cycle theorists of the widening and the deepening of the scope of control. Widening then is the procedure of giving the leader the ability to conduct more workers on the level just below his own, in other words the procedure of enlarging the span of control, deepening that of improving the quality of reception of the leader's commands at the lower levels and finally at the bottom of the pyramid.

The whole management-technique can be explained as a means for extending control in the sense of widening and deepening as well; widening and deepening being to some degree alternatives, as we shall show, we can speak of seeking a balance between them.[8]

[8] In his introduction to the proceedings of the International Management Congress Kruisinga seems to mean that the limitations of the span of control give rise to the problem

2. *Maintaining the span of control as the underlying principle in the organization of growing enterprises; the stratification in management and its consequences.*

In my opinion all problems of organization and management technique originate in a certain degree from the fact that the scope of the leader's control is for many reasons limited. Therefore we can see organization and all other tools of management as a consequence of a struggle for widening and deepening the scope of control or, i.e. enlarging the span of control and the depth of control.

If the scope of control was only a question of a man's capacity and there were no means of enlarging it, organization would be only the problem of choosing men of adequate capacity for large and small business and for higher and lower ranks respectively. This solved, management could not give any further difficulty.

The effect of the limited scope of control in its horizontal direction, i.e. the limitation of the span of control, on the organization-structure of growing business-units is a very remarkable one. It does not cause simply a multiplication of the number of leaders but also causes more levels of management to come into existence. The smaller the span of control, the more levels will appear. Therefore, the functional distance between top-management and the ultimate performers, the labourers, grows as business grows.

The growing distance gives rise to a manifold loss. First of all there is the danger of distortion of an order on its way from the top to the bottom. On the other side there exists still a greater danger: the mutilation of returns on their way from bottom to top. Moreover, the longer distance means that more time is needed for an order to reach the bottom. Therefore, the long distance forms a hindrance to immediate action. Finally the costs of management are growing in a more than proportional way.

If we call the number of leaders L, that of labourers A and r the span of control (being the same on all levels) we find the following formula for the total number of leaders:[7]

$$L=\frac{1}{r}A+\frac{1}{r^2}A+\ldots\ldots\ldots+\frac{1}{r^n}A=\frac{1}{r^n}A\,\frac{r^n-1}{r-1}$$

As L represents the total number of leaders on the different levels, we have expressed this number in our formula as a function of r and

of maintaining the 'unity of authority'. Op. cit., p. 4. As pointed out in this article the limitations of the scope of control are at the base of the whole set of problems concerned with management and managerial control. Cf. J. L. Meij, 'Functie-vorming als centraal organisatie-probleem,' in the organization number of *De Naamloze Vennootschap*, May-June 1954.

[7] The supposition of the span of control being the same on all levels may be rather unrealistic. It is only used for simplification. See note 8.

n. The items r and n not being independent variables, we can express n in terms of r, or r in terms of n, as the case may be.

If we may suppose that the top is formed by one leader, president or general manager and therefore $\frac{1}{r^n}A=1$, we can write for r:

$$r=\sqrt[n]{A}$$

The span of control is presented here as a function of the stratification, the number of levels. As already said, we can conversely express the stratification as a function of the span of control:

$$n=\frac{\log. A}{\log. r}$$

As log. A is constant, A being given, n and log. r have a constant product; therefore we can say n is inversely proportionate to log. r. An increase of r therefore causes a diminution of n proportionate to the increase of the logarithm of the span of control.

The number of leaders can be represented as a function of the span of control in this case by:

$$L=\frac{A-1}{r-1}$$

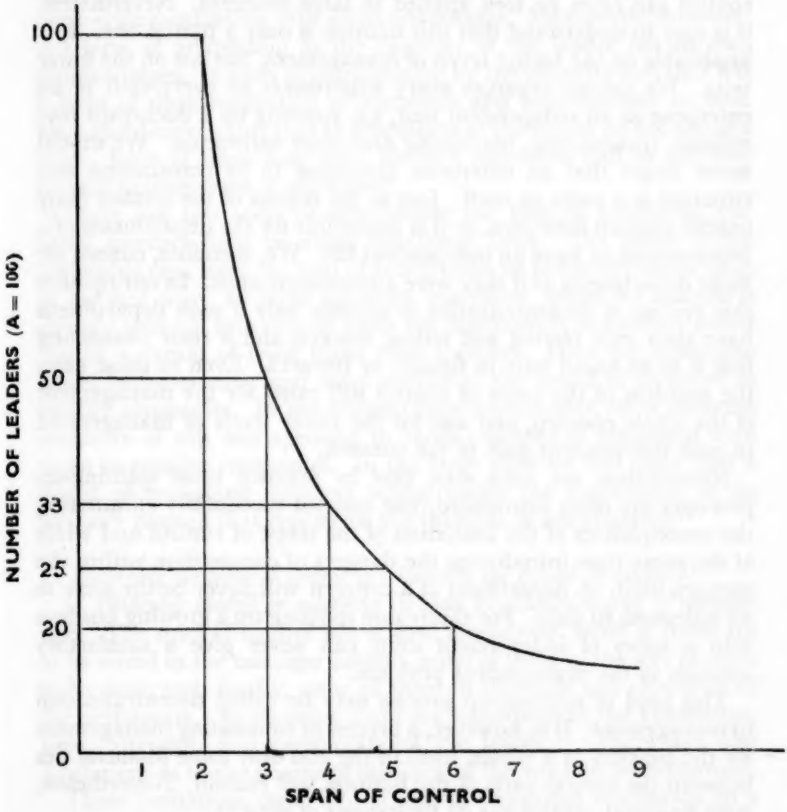
With this formula the total number of leaders can be derived — A being given — from the span of control.[8] Expressing this function graphically we find the hyperbola shown on the next page.

Our formula may demonstrate the great influence of the span of control on the number of leaders, the number of management-levels and accordingly on the functional distance between the top-management and the workers. Finally it shows the influence of the span of control on the cost of management.

Our central point in developing a workable theory of management therefore is: *how to enlarge this span of control on every level of management.* Only in this way can we counteract both the increasing distance from top to foot and the increasing cost of management in expanding business-units. Hitherto we have presumed the span of control to remain the same at all levels of management. It is a matter of fact that at the higher levels the span is smaller than at the lower ones. Nevertheless, this does not vary our general conclusion as to the increasing number of management levels when business is expanding.

[8] The above developed functions hold true for every definite number of top-managers. If we suppose two, three or more leaders at the top we find:

$L=\frac{A-2}{r-1}$ $L=\frac{A-3}{r-1}$ and so on.



The only consequence is that the increase becomes still more progressive.[9]

3. *Adapting size of task to the leader's capacity; splitting up the business in a series of small and less complicated ones; formation of boards.*

Before discussing this central point, we want to draw the reader's attention to the fact that there is still another way to escape from disadvantages of the limitation of the scope of control. We can, when we fear that the span of control will be exceeded, split up the business in a certain number of units, each with its own leaders. This form of decentralization in management and managerial

[9] Cf. A. de Jong: *De menselijke factor in de bedrijfshuishouding en de bedrijfseconomische problematiek*. Leiden, The Netherlands 1954, p. 177 note (summary in English).

control can often be seen applied in large concerns. Nevertheless, it is easy to understand that this solution is only a partial one. It is applicable on the higher levels of management, but not on the lower ones. We cannot organize every department or every shift in an enterprise as an independent unit, e.g. splitting up a dock-yard into drilling, transporting, machining and other enterprises. We should never forget that an enterprise according to its constitution and structure is a unity in itself. Just as the organs of the human body cannot exist on their own, so it is impossible for the departments of a business-unit to have an independent life. We, therefore, cannot see those departments as if they were autonomous units. In our opinion this process of decentralization is suitable only if such departments have their own buying and selling markets and if their connecting link is to be found only in finance or research. Even in these cases the problem of the scope of control still exists for the management of the whole concern, and also for the lower levels of management in each independent part of the concern.

Nevertheless, we have seen that in practice these splitting-up processes are often introduced, but without successfully eliminating the consequences of the limitation of the scope of control and while at the same time introducing the dangers of competition within the concern itself. A department of a concern will never be the same as an independent shop. For this reason splitting up a growing business into a series of independent units can never give a satisfactory solution to the management problem.

This kind of splitting-up process may be called decentralization in management. It is, however, a process of eliminating management for the concern as a whole, until in the end only some financial ties between the several parts of the business will remain. Nevertheless, even financial control has its limitations of span.[10]

In this process the size of the business-units is adapted to the capacity of the leader. We do not try to enlarge the scope of control but going the other way round try to contract the size of the business-unit.

There is, however, another way of adaptation to the leader's capacity: managing by boards. The formation of boards can be considered as a means of subdividing the task of managing and distributing it over a number of managers. In lieu of splitting up the unit the task is subdivided.

Like the former process this one is also limited to the top rank of management and is not applicable to the lower ones. It has the advantage that the size of the unit does not depend on the capacity

[10] There may be other ties holding a concern together, e.g. the experience or wisdom of a central laboratory, etc.

of the leader alone. His limited capacity forms no hindrance to large-scale production with all its advantages. Meanwhile, however, this form of adaptation to the capacity of the leader has its own disadvantages. It leads to management by the majority and thus it is a form of decentralization of authority and responsibility as well. Here the danger exists that the members of the board do not act as a unity. Each of them may have his own objectives and as a consequence management is weakened.

There are two ways of subdividing the task of managing, viz. along product lines or along functional lines. The latter is the preferable one, since the unit of activity can be preserved better than in the first way. In large concerns, moreover, where the business is already split up into several units the functionally organized board can be a means of tying those units together. Here the managing board becomes more and more similar to the board of directors in smaller companies. In my opinion here lies a reason for a different structure of top management in large concerns as compared with those in smaller companies. In the large ones we will often find a board of managing directors acting under the supervision of an advisory council that represents the interests of stockholders.[11]

4. *Enlarging the scope of control in relation to the growth of business:*

a. *Widening control or enlarging its span by functionalizing of management.* The span of control has several limitations; some of them are to be found in the manager himself, some of them in the sort of work to be done and, finally, some of them in the style and character of the performers. As we know there are limitations in the knowledge, time, attention and personality of the leader.[12] There are also limitations as to the degree of intricacy of the work to be performed.

Those limitations come into action, as Graicunas has shown, in a progressive way when the number of performers is increasing.[13] According to this author it is particularly the co-ordinating task of the leader that increases progressively in relation to the number of performers. The extension of the span of control gives rise to a sort of de-naturing of leadership. From a directing activity it becomes a correcting one: from preventive action it grows to a repressive one. The first and natural reaction to this extension of the span of

[11] Compare for example the management-structure pattern of Unilever and other large concerns.

[12] Petersen and Plowman, *Business Organization and Management*, Chicago 1949, p. 91.

[13] A. V. Graicunas: 'Relationship in Organization' (*Bulletin of the International Management Institute*, March 1933) gives the following formula for the number of contacts of a leader with his subordinates: $C=N\left(\frac{2^N}{2}+N-1\right)$, C being the number of contacts, N the number of subordinates. A linear increase of N leads to a progressive increase of C.

control is the increase of the number of levels of management and of the number of leaders on the same level (multiplication) which we have described before.

As we saw, this development is unsatisfactory in its ultimate effects. Management becomes less effective and costs increase. Therefore, one of the most important problems of the science of management is to find out other systems of organizational structure, systems which are both more effective and less expensive. Since the days of F. W. Taylor this has been the first problem on which management specialists have focused their thoughts. However, they did not base their solution on general principles.

The basic principle of organization and therefore of all management can be considered to lie in making control adequate to the needs of growing enterprises in the most effective and least costly way. It is in this form that economic principles appear in the theory of organization. In general the central problem of organization is the appropriate expansion of the scope of control. In accordance with the definition given in section 1 the concept of the scope of control is related to all levels under the leader's supervision. We have distinguished therefore two forms of its expansion, viz. the widening, which enables the leader to have more performers under his direct control and the deepening which enables his will to penetrate into all levels below him. In common speech the expansion of the scope of control is only considered in horizontal direction, in the sense of widening. Deepening control, however, is of no less importance. Let us first of all give our attention to the means of widening control, of enlarging its span.

The first attempt to widen the span of control can be considered as being the functionalizing of management, an attempt made by F. W. Taylor in his introduction of functional foremanship. Functionalizing means limiting the functions the leader has to perform. Now, in leadership, it is implicit that all functions of the leader are related to the task of his subordinates. Functionalizing therefore means the division of the tasks of the subordinates into more or less primary elements and the specialization of the leaders on the guidance of the subordinates in fulfilling those task-elements.

This limitation which functionalizing brings about means a substantial widening of the span of control. However, at the same time it means a substantial increase of the number of leaders. Taylor's device was 'one man but one function to perform' but consequently one should have as many leaders as functions to perform. Moreover, we must be aware of the fact that we can apply the principle of functionalizing but once. Taylor intended

as a consequence to use it for the foremen's span of control. However, once used here, it is clear that it could not be used on a higher level.

If we wish to know if the principle is of value we must compare the widening of the span of control of each leader with the increasing of the number of leaders according to the number of task-elements into which the work of the subordinates can be split up. Having in the old-fashioned foremen-system a factory with 16 labourers and the span of control of the foremen being 2, we need 8 foremen. If we can distinguish 4 task-elements and let the span of control for each element be 8, we also need 8 foremen. The span of control must be widened further if a gain is to result.

If we call the new span of control r_1, and the number of task-elements a, the number of leaders on one level is $\frac{a}{r_1} \times$ (number of labourers). In the traditional system the number of leaders of one level is always $\frac{1}{r} \times$ (number of labourers), r being the original span.

Functionalizing gives a gain if $\frac{a}{r_1} < \frac{1}{r}$ or $a < \frac{r_1}{r}$. If $a = \frac{r_1}{r}$ the number of leaders on the same level remains the same and the widening has no result. Since we cannot expect that a is always $< \frac{r_1}{r}$ functionalizing will not always be a method of decreasing the number of leaders and diminishing the levels of management.

b. *Splitting off constitutional work.* There is another way of widening the span of control. The leader can delegate more initiative to the performers. In itself the fact of delegation cannot be denied but it means a widening on account of the deepening. As a consequence it has only a limited range of application if not accompanied by other means of deepening. We will therefore treat this question in the following section. Without these counterbalancing measures delegation tends to weaken leadership. From directive and preventive, leadership becomes more and more repressive and corrective, and in the end all leadership would fade away. This withdrawal of leadership cannot be a desirable consequence of the growth of a business. It must be prevented. Our objective must be to widen and deepen the scope of control without weakening the leadership in any direction.

In our opinion the principal way of widening may be the separation of constitutional work from the leader's task. We may divide all work of a leader into two groups: a constitutional and a directing

one. It is rather difficult to draw a sharp line of demarcation between the two. We can only say that all work that can be repeated, all work remaining the same in the leader's task for a shorter or a longer time, can be made constitutional. It can be done according to a previously prepared pattern or directive. The directives once prepared can be used for a whole range of orders of similar character.

We can therefore try to divide the work of the leaders between two sorts of men: those who make the directives and those who are in command only; the latter are the leaders in the most strict sense. The span of control can be widened substantially by doing this. For constitutional work the span is practically unlimited. Perhaps one could better say that constitutional work, as it is not 'leading' work at all, has no span of control. The drawing up of an instruction or directive can be done for one labourer, for ten or for a thousand; the amount of labour needed remains the same.

By splitting off this constitutional labour a lot of work is lifted from the shoulders of the leader of a group. Now he has only to give his orders and to supervise their performance. Sometimes he has to modify his orders as circumstances change but he has never to prepare the actual directives. As constitutional work asks for specialist-knowledge we can say that the splitting-off diminishes the limitation of the span of control caused by the need for such knowledge. In other words: it widens the span of knowledge.

It is obvious that all leadership-work is simplified if it can be done according to schemes prepared previously and moreover it is obvious that by simplifying the work of the leader his span of control is widened. Here, too, we have a good reason to expect that the number of persons involved in the management will diminish. As constitutional work has no limitations as to the number of performers nor as to the time taken, it will be clear that the decrease of the number of leaders according to the widening of the span of control will not be offset by the increasing of the number of men now necessary to do constitutional work.

The splitting off of constitutional work has still other advantages. The qualities which make a man a good commander are not the same as those that are necessary for good organizing. It will seldom be seen that one man fulfils both conditions in the same degree for we have to do here with two different types of men. In this respect it serves as a means of widening the span of control in its relation to the capacity of the leader. Here we can say that the limitation due to personality is diminished.

The constitutional work becomes the task of specialized staff-employees. The splitting-off of constitutional work gives rise to the

so-called line and staff organization. Almost all modern organization-schemes are built upon line and staff principles.

Moreover we may say that such splitting-off has also a human-relations aspect. We can meet the desire on the side of the workers to have a say in management and we can fulfil it in a more practical and satisfactory way than by means of industrial councils of any type, since this splitting-off enables us to consult groups of labourers, directly interested, on measures of a constitutional character. Works councils can have but a very limited significance in business life. We can hardly expect it to give great satisfaction to the workers just to have the possibility of electing their representatives on a council. The questions brought by such councils are for the greater part of minor importance. Leadership is not a subject for councils but for individuals. The forms of democracy developed in local and central government cannot be introduced into business life. That is the fallacious philosophy all the ideas of industrial councils have been based upon. Members of parliament or county councils are elected for the principles or the parties they represent. We cannot run a business along different principles represented by the different members of a works council.

There is still another aspect of widening the span of control, viz. the mechanization of command by forms. The form in its course gives automatically the necessary commands. It is clear that the form is only applicable when the procedures are standardized, as is the case with mass-production and such business as life-insurance and banking. The form is order and report at the same time. It gives its commands to the leader at the lower levels and on its way back it serves as a report to the leaders at the higher levels. The designing and routing of forms is also a part of constitutional work.

The scope of control also can be said to be deepened by using forms. Commands and reports are prevented from being mutilated on their way from and to the top respectively. The commands are received in the lower ranks as the leader has wished to give them and the reports are received by the leader in the same manner.

c. *The deepening of the scope of control by preparing the orders for lower ranks; budgetary control as a means of strengthening the preventive element in control.* We are now going to speak further about the deepening of control. In practical life we may state that there is no sharp line of demarcation between widening and deepening with reference to the scope of control. Yet it may be useful to make a distinction between the two in the theory of management.

As we have stated above, in a growing business the distance

between leaders and others becomes larger and larger. We can counteract this tendency by widening the span of control of the leader but still it exists. We must therefore look for means to enable the will of the leader to penetrate the different levels of management and reach the performers without delay and mutilations. In other words, we must try to strengthen the preventive element in management. We may call this deepening the scope of control or enlarging the depth of control. There are several means of reaching that goal. As Limperg has pointed out, we can consider the making of instructions, standardizing, budgeting, planning and in a certain degree routing and scheduling as means to reinforce the preventive element in management.[14] These means are already well known in organization theory as also in practice. However, all those different means can be considered too in their relation to the deepening of control.

We will limit ourselves for the most part to standardizing and budgeting. Standards are a means of widening the span of control as they enable the leader to give his commands in a simpler form. Moreover, the setting up of standards can be considered as constitutional work and be split off.

Nevertheless, standards are also means of deepening the scope of control. As far as the performance of commands on the higher level is based on standards, there can be no doubt about the leader's will. Standards of performance, once fixed, are decisive for the use of raw material, labour and other factors of production too, for to each method of performance there corresponds a certain amount of labour, raw material and other means of production. It is an economic problem to find the right method of performance out of several ones that are technically possible. Therefore, the fixing of standards is not only, or in the first place, a technical question, but also and still more, an economic one.

The standard of performance may vary with the scale of production, with the size of the series of products and with the values of the different factors of production. As a consequence the amounts of labour and of the other factors used in the process of production vary too. Therefore the optimum method of performance and the standards deducted from it are relative items.[15] However, we cannot always pursue the optimum method of performance. If, e.g., the equipment cannot be altered, we are obliged to choose the best method within the limits given by the actual equipment. These standards can be described as 'building blocks' for making

[14] Dr. Th. Limperg, until 1949 professor of industrial economics in the University of Amsterdam, in his courses on organization.

[15] This conclusion is in accordance with those reached by Ragnar Frisch, Kenneth E. Boulding, Sune Carlson and others in their theories of production.

instructions with respect to planning, budgeting, routing and scheduling as well.[16]

In large concerns it becomes impossible for the managers at the top to direct their leaders in lower ranks by immediate command even if standards for the ultimate performance are in use. Budgeting and budgetary-control then become necessary. This necessity is a consequence of geographical or functional distance. First we have seen the development of the budgeting-system in business-life in our country in the companies operating in our former colonies, especially in the East Indies. The top-managers of those companies for various reasons remained in Europe, near the markets where their products were sold. This was rational in a certain respect, but on the other hand they could not give any direct command to their employees overseas. Hence the budget-system was introduced to meet the difficulties.

Nowadays the functional distances arising in large concerns are giving the same difficulties. Here, just as in the case of geographical dispersion, the will of the leader cannot reach the lower levels of management nor the level of performance. The budget-system has therefore been chosen to solve the problem. The budget-system once applied becomes a method of distributing authority and responsibility over the lower ranks of management. Therefore with this system the scope of control can be enlarged in depth or deepened to a certain degree. Here, as in the case of standards, the work of preparing the budget can be split off from the leaders and shifted to specialists.

Here, too, we have another possibility of giving the workers a say in management. We can use their knowledge of the tasks to be performed in setting up standards and making preparations for the budget. In this way we can stimulate their interest in the business, and can hope to make labourers feel themselves as important and responsible links in the process of realizing its objectives. Therefore, it seems to be of great value to set up the standards in agreement with and after discussion with the workers. This brings a far better condition for the realization of standards and budgets, for now the labourers are responsible for things they agreed to beforehand. We may therefore conclude that both widening and deepening the scope of control open large possibilities of giving labourers a say in management. We do not need, as in our country, to constitute 'industrial councils' and then look for work for them. The application of modern principles of management opens the possibility of giving labour a say where it is really wanted, where it is really important.

[16] Billy E. Goetz refers to standards as 'building blocks' for management. *Management Planning and Control*, New York/London 1949, p. 92 and further.

The participation of workers in management in this way has still another advantage. As we have shown, the possibility exists of widening and deepening the scope of control of the leaders as business grows. It is clear that there is not only a necessity to expand the scope of control; it is necessary also to enlarge the possibility of the leader being responsible for a larger group of men. In accordance with our definition of the scope of control we may call the number of workers for which the leader can be held responsible his scope of responsibility.

We now may ask: is it equally possible to expand the scope of responsibility? In my opinion the means at present in use to enlarge the scope of control do not automatically widen or deepen the scope of responsibility.

Giving the workers a say in the fixing of standards and the building-up of budgets means letting them participate in the leader's responsibility. The responsibility and even the accountability of the latter will not diminish in this way nor are they altered. But the ability of the leader to bear them is substantially enlarged.

d. *Adequacy in the distribution of functions; internal checks.* Control can be made simpler and more effective if we are able to distribute tasks in such a way that performances control one another to a greater or less extent; in other words, if we are able to set up internal checks. Therefore, adequate distribution of functions can be considered in this respect as a method of enlarging the span of control.

Some functions are to be regarded as real incompatibilities. The performances of the one cannot be combined with that of the other. A bookkeeper for instance cannot be put in charge as a cashier nor in general can he have proxies. In general we cannot combine functions of registering and store-keeping, nor can we give decisive management-power to registrars. Though these principles are familiar to auditors and accountants, they are often set at naught in business-life, and not only in smaller units. Nevertheless, they are very important, and not only in the administrative section but for the business as a whole.

If these rules are infringed, effective control is hardly possible, even with the utmost endeavour. Therefore it seems to be the task of good organization not only to avoid these incompatibilities but also to create effective internal checks. Making an organization adequate in this respect means not only widening but also deepening the scope of control. Where internal checks are lacking, control becomes more and more difficult and, of course, its span as well as its depth limited.

5. *Finding the balance between decentralization and centralization is a process of handling the above mentioned principles in respect of the size of the enterprise.*

We can form now a better opinion on the problem of centralization and decentralization in management. Centralization and decentralization are not to be considered as two contrasted principles of management (or of managerial control, a somewhat narrower term than management). Management is always centralized. Without centralized control there will be no leadership and without leadership there will be no possibility of reaching the objectives of the business. The optimum structure of management is in general that with one leader at the top. Even if top-management is concentrated in a board there is often a general manager or chief with the power to make the conclusive decisions, after having considered the different proposals, in the light of the interests and objectives of the whole concern. If we have two or more chiefs at the top there cannot be unity in management, even when all decisions are taken in complete harmony. In every concrete case the members of the leading group may harmonize, but the danger still exists that the unity of conception is lost during the life-time of the concern if in one case the view of one member is followed, and in another case the view of one of the others. This danger is the more actual the more the leaders are specialists in different fields of the business.

Initiative and authority can be delegated to managers on a lower level but the authority on the top remains unaltered. The responsibility of the lower leaders exists only to those on the higher level. The responsibility of the top-manager vis-à-vis share-holders and other people interested in the concern or their representatives is not and can never be diminished. Managers on a lower level can never be obliged to render account for their policy over the head of the top-leaders to directors, shareholders or other people connected with the company. Responsibility and accountability of the leaders of lower ranks are always internal and therefore do not diminish the external responsibilities and accountabilities at the top. Even if the only link between the parts of a concern consists in the annual budget for capital and operating expenses and the responsibility of the departmental leaders for it to top-management, the latter still remains centralized.

What we are doing if we delegate authority and initiative to lower ranks is only a procedure for mutual adaptation of the size of management and the scope of control of the managers. This procedure cannot be executed simply by multiplying the number of leaders at the same level, nor by multiplying the number of levels.

By multiplying the number of leaders the unity of leadership is lost, by multiplying the number of levels the connection with the performance is lost. Therefore the process of widening and deepening the scope of control must be put into action.

If the enterprise grows in size, we must widen and deepen the scope of control of the leader in consequence of the higher demands made on him. We may call this procedure decentralization in managerial control but this term is misleading for the control must always remain centralized. It is only a means of enlarging the scope, not of substituting one form of managerial control by another.

6. *Conclusions.*

Coming to the end of our reflections it seems desirable to sum up the conclusions reached. We have seen that organization is not a question of choosing between centralization and decentralization in management and control but that it can be characterized better as a struggle for adequacy of the scope of control at all levels of management in a growing enterprise. It is impossible to counteract the increasing tendency to exceed the scope of control by splitting up a growing concern into a number of smaller ones. By doing this, we would counteract the economic forces which have led to the growth. We cannot meet the needs of the growing business simply by multiplication of the number of leaders; multiplication means at the same time formation of new levels of management.

The formation of new levels is in a certain degree adequate to prevent the exceeding of the span of control, but the distance from top-manager to performer becomes too great to be sufficiently bridged. Therefore, new methods must be brought into use to widen as well as to deepen the scope of control.

The central problem of organization therefore is not to find the balance between centralization and decentralization in managerial control but to find the balance between widening and deepening the scope of control. The equilibrium between both is found, as always in such problems, by using the principle of substitution. Here as in all other problems of substitution there will be a least-outlay-combination that we must try to find out.

UNIVERSITY OF GRONINGEN,
THE NETHERLANDS.

INVESTMENT DECISIONS AND THE NON-LINEAR CYCLE

by CLARENCE JUNG

IN much of recent economic literature, business investment in plant and equipment is alleged to bring about extreme variations in the level of economic activity. This interrelationship between investment and income has been of concern to economists for some time, but recent analyses have re-emphasized the 'bunching' of investment activity (or inactivity) at particular points in time. Such 'bunching' reflects, it is asserted, a tendency for businessmen to add to plant and equipment when the demand for their products is rising but to cease all expansion when this demand is horizontal and certainly when it is falling. Because of the multiplied effect of investment spending on aggregate income, the latter tends, according to this analysis, to change its direction abruptly and to swing widely. In technical terms, this assumption as to investment decisions creates a non-linear cycle of national output and income — i.e., one which is characterized by sudden jumps and discontinuities.

In this paper, strong question is raised whether the nature of entrepreneurial decision making is such as to generate discontinuities, or breaks, in investment action and in the national economy. Here it will be argued that discontinuities of this sort are apt to occur only in an atypical situation, that of a money-panic condition which is outside the entrepreneur's range of influence. In the more usual situation, business investment decisions are made on a basis which brings about more gradual and less extreme movements of total investment and hence of total income.

I. THE NON-LINEAR CYCLE

Non-linear theories of the business cycle assume several forms. In some cases, as for example in Hicks's *Trade Cycle*, non-linearity is implicit in certain postulated constraints on the business cycle, viz. limitations on the capacity of investment goods industries and the impractical nature of disinvestment in durable goods. In other cases, the assumptions of discontinuity are more explicit, as in R. M. Goodwin's work on the non-linear accelerator. The analytical patterns represented by the writings of Domar, Harrod, Kalecki and others can be interpreted in a similar manner.[1]

[1] Cf. Duesenberry, James, 'Hicks on the Trade Cycle', *Quarterly Journal of Economics*, Vol. LXIV, 1950, pp. 465-6, for a concise outline of the cycle as Hicks has described it.
On non-linear models see Goodwin, R. M., 'A Non-Linear Theory of the Cycle',

The income-investment models devised by Goodwin illustrate the oscillatory process which is said to follow from continuously recurring discrepancies between capital stock and the aggregate amount of capital stock desired by entrepreneurs. Only the most basic of Goodwin's non-linear models will be examined here. In this most elementary case, the assumption is that when entrepreneurs find their capital stock different from what they consider to be optimum, 'the economy seeks the perfect adjustment of capital to output and that it does so in either of two extreme ways, capacity output of investment goods or zero gross investment'. This assumption leads to a cycle which may be depicted by a square wave, as outlined in Figure 1, according to Goodwin.

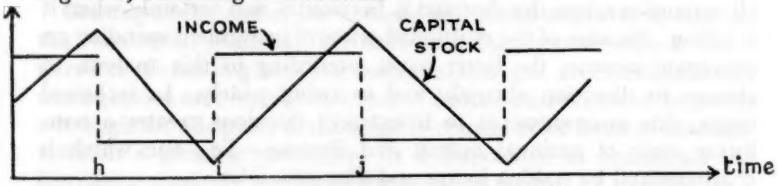


FIGURE 1

This model is from Goodwin's work and shows points of discontinuity at h, i, and j. These points of discontinuity are a reflection of the assumption that the economy, through the actions of individual entrepreneurs, adjusts actual to desired capital by either capacity output or zero output of investment goods. It is this assumption which the present paper examines, with respect to its psychological, theoretical and empirical foundations.

II. THEORY OF DISCONTINUOUS CHANGE

As shown in Figure 1, a point of discontinuity refers to a 'jump' in the value of a variable. That is, one variable does not appreciably change while another variable changes rapidly enough to make the details of its change of no significance. Non-linear equations are characterized by their attention to such points of discontinuity, where, as a given variable acquires certain values, its rate of change may be such that the parameters of the system actually change.

Review of Economics and Statistics, Vol. XXXII, 1950, pp. 316-20, and 'The Non-Linear Accelerator and the Persistence of Business Cycles', *Econometrica*, Vol. XIX, 1951, pp. 1-17. See also Chenery, H. B., 'Overcapacity and the Acceleration Principle', *Econometrica*, Vol. XX, 1952, pp. 1-28, and Fisher, G. H., 'A Survey of the Theory of Induced Investment, 1900-40', *Southern Economic Journal*, Vol. XVIII, 1952, pp. 474-94.

A recent summary of the Harrod-Kalecki-Domar school may be found in Theodore Levitt's 'Investment, Depression, and the Assurance of Prosperity', *Journal of Finance*, Vol. IX, 1954, pp. 235-51. Professor Levitt's discussion implies certain elements of discontinuity. This school asserts, according to Levitt, that it is 'expansion of cap tal plant that makes business recession such a persistent and perhaps inevitable possibility'.

In certain electrical and mechanical systems, conditions are sometimes such that the rate of change of a variable is effectively of an unlimited nature. This occurs when the rate of change is abrupt compared with the change in another variable and large in comparison with the 'saturation value' of some characteristic of the system. Andronow and Chaikin, in their *Theory of Oscillations*, describe various situations in which one variable achieves what is effectively an instantaneous jump to some critical value, thereby triggering off changes in another variable of a greatly magnified nature.

If, for example, an initial oscillating variable, x, of relatively small amplitude is introduced into a system, it may cause another variable, y, to jump almost immediately to its saturation value. This is diagrammed by Andronow and Chaikin as follows:

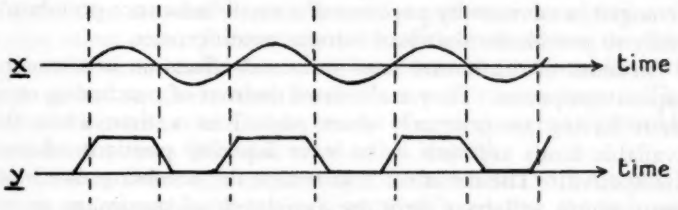


FIGURE 2

One might interpret these variables as relating to an electrical system, or as representative of economic factors. For example, x might be a small fluctuating voltage applied to the grid of a vacuum tube where y is the resulting plate current. Or, x might represent changing aggregate demand and y the resultant undercapacity of capital equipment. The key phase of these inter-couplings is the attainment of an instantaneous saturation value for variable y.

These functions describe the assumption required of the non-linear accelerator, viz. an instantaneous triggering off of investment activity in response to changing aggregate demand. While the timing of investment response to such changing aggregate demand may vary from one industry to another, the issue is explicitly raised whether the economy, through the decisions of entrepreneurs, seeks the adjustment of actual to desired capital in an extreme fashion. The contention here is that, while there are discontinuities in investment action, they are best explained in other terms.

III. THE PSYCHOLOGY OF BUSINESS EXPECTATIONS

Investment action is a consequence of 'entrepreneurial' expectations. ('Entrepreneurial' may be interpreted here as the decision

center, complex as it may be, of the firm.) Certain empirical and theoretical considerations indicate that these expectations are not likely to produce extreme adjustments in capital stock, except in one case to be noted later. Business expectations are controlled by factors which operate to limit the number of extreme adjustments. Here one group of constraints will be called *survival* factors, or 'safety first' considerations. Another group will be labeled *minimax* factors, or those making generally for intermediate, rather than extreme commitments.

Actions designed to assure a firm's survival, center around financial provision for possible catastrophes. For example, insurance premiums and liquidity measures may cost more than is actuarially justified, but these may be viewed as worthwhile hedges against an uncertain future.[2] Various types of bank loans, for example, are arranged in advance by payment of a small 'insurance premium' in order to provide for the more extreme contingencies.

Anxieties of this nature have collateral effects on investment in capital equipment. They make firms desirous of purchasing equipment having an extremely short pay-off at a time when their available funds are such as to leave liquidity positions relatively unimpaired.[3] The net effect is to reduce the possibility that investment action will have only the two levels of maximum or zero intensity. Certainly individual firms will not want to operate at the capacity level of investment in new equipment because their desire for liquidity will prevent such commitments. On the other hand, firms will ordinarily invest in some new plant and equipment more or less habitually because replacement funds automatically accrue, and retained earnings may be available for modernization.

Minimax factors are given a label which belies their mundane

[2] Hart, A. G., *Anticipations, Uncertainty, and Dynamic Planning*, Chicago, University of Chicago Press, 1940. Also Roy, A. D., 'Safety First and the Holding of Assets', *Econometrica*, Vol. XX, 1952, pp. 431-49; and Friedman and Savage, 'The Utility Analysis of Choices Involving Risk', *Journal of Political Economy*, Vol. LVI, 1948, pp. 279-304. The actions mentioned here are more costly than those which would be required to meet 'risk' situations which are capable of actuarial calculations.

[3] Terborgh, George, *Dynamic Equipment Policy*, McGraw-Hill Book Company, 1949, p. 189. Terborgh cites surveys showing that probably the two most important factors in purchase of new equipment are the cash pay-off and availability of funds. Interviews with executives at various levels of the corporate structure will quickly confirm this point. Terborgh criticizes the short pay-off requirement, although such a criterion is a thoroughly typical reaction to uncertainty.

Edgar M. Hoover, commenting on Joel Dean's contribution to the National Bureau of Economic Research report on *Regularization of Business Investment*, notes that: 'Uncertainty is probably the main reason for reluctance to commit resources to fixed investment in advance of a known need, and for the effort to maintain a more liquid position in bad times than in good. Uncertainty is the basis of many of the rules of thumb used for appraising investment opportunities – such as the short pay-off criterion – which place great emphasis on quick turnover and proximate profits and discount the more distant future nearly or wholly to the vanishing point.'

character. In the absence of complete information, human behavior generally takes some form short of complete commitment. Sometimes individuals merely 'mark time' in the face of uncertainty. Occasionally they may engage in 'probing' actions which are intended to clarify their expectations. Any 'surprise' is likely to elicit rapid withdrawal if unfavorable — a pause if favorable.[4] Generally, action will take some intermediate course if, indeed, there is any commitment at all. This is the qualitative nature of rational action under incomplete information as described particularly by von Neumann and Morgenstern, Marschak, Savage, Arrow and others.[5]

For any action occurring with less than complete information, at least two, and usually more, sets of consequences may ensue. These sets of consequences may be called, for example, favorable and unfavorable. For any particular set of consequences (say unfavorable) the firm may have some idea of the outcomes associated with varying input costs. Further, for each of these outcomes the firm may be able to estimate what could have been the outcome for each input under an alternative favorable set of consequences. The difference between return under one set of consequences and possible return from a more favorable set is called 'regret'.

In order to arrive at a commitment not associated with too much risk but one capable of bringing a worthwhile reward, the firm will choose an *intermediate* investment which occurs at the minimum of the maximum regrets.[6]

The theoretical foundations of this point, and their ramifications, will not be examined here. However, the conclusion seems clear that firms are likely to choose their investment actions from among

[4] Formal expression is given this point in Hart, op. cit., and Shackle, G. L. S., *Expectation in Economics*, Cambridge University Press, 1949.

[5] Arrow, Kenneth J., 'Alternative Approaches to the Theory of Choice in Risk-Taking Situations', Cowles Commission Papers, New Series No. 51, Reprinted from *Econometrica*, Vol. XIX, 1951, pp. 404-37.

[6] For a readable exposition of this principle see Franco Modigliani on 'Liquidity and Uncertainty', *American Economic Review*, Vol. XXXIX, 1949, pp. 201-8.

Jerzy Neyman and E. S. Pearson should probably be credited with the first statement of the *minimax* decision. In 1933 they pointed out that the problem of statistical testing of hypotheses is complicated by the range of consequences pursuant to the acceptance of a false hypothesis. Cf. their paper on 'The Testing of Statistical Hypotheses in Relation to Probabilities, *A Priori*', in *Proceedings of the Cambridge Philosophical Society*, Vol. 29, 1933, pp. 492-510. J. L. Hodges, Jr., in his *Discriminatory Analysis* published by the United States Air Force School of Aviation Medicine, has stated the problem as that of finding a course of action for which the 'maximum of conditional risks is a minimum'.

For a good non-mathematical treatment, see Donald, John, *Strategy in Poker, Business and War*, W. W. Norton and Company, 1950. For economic implications, rigorously developed, there is the classic work by John von Neumann and Oskar Morgenstern, *Theory of Games and Economic Behavior*, Princeton University Press, 1947. Borel is said to have made early contributions in this field, according to Frechet, in a recent journal article. ('Emile Borel, Initiator of the Theory of Psychological Games', *Econometrica*, Vol. XXI, 1953.) One of the best recent summaries is that by Ward Edwards, 'The Theory of Decision Making', *Psychological Bulletin*, Vol. LI, 1954, pp. 380-417.

more than two extreme alternatives. In terms of cyclical investment policy, Joel Dean has noted in his *Capital Budgeting* that firms may employ a variable standard of marginal productivity in deciding on the extent of investment in new plant and equipment.

Basically, the problem which the decision makers face within a firm are analogous to those faced by the statistician. There the problem, as stated by Abraham Wald in his *Statistical Decision Functions*, is whether additional sampling will yield information worth more than the cost of obtaining it.

While there seem to be no completely adequate analogues of business behavior involving sequential decision, communication theory contains a concept which has some relevance to this question. This is the term 'redundancy', which refers to the amount of information common to both the input and output of a system.[7] Generally, the more redundancy there is, the more predictable is the output. Further, individuals require a considerable amount of redundancy of information before they feel much confidence in their predictions about the future. One obvious inference is that firms, and individuals, will desire a considerable accumulation of information before they act. Shubik has noted recently a 'pressing need for the study of decision-making under low information conditions'.[8]

That this seems true of individual (and firm) behavior is borne out by recent studies in psychology. Hull's fundamental work in learning theory, for example, shows the importance of 'reinforcement' of responses. His 'reinforcement principle' asserts that the greater the number of times a particular behavior is rewarded, the greater is the tendency for the response to recur in similar situations. In like manner, one might expect that firms will continue to behave in ways which have been rewarding in the past and these patterns will not be easily extinguished. Thus, 'sudden learning' as described by Katona may be a rather uncommon phenomenon. Hull's concepts (as expounded in, say, *A Behavior System*, in 1952) of reinforcement, inhibition and stimulus generalization describe behavior as more continuous than abrupt. Learning, as interpreted by the Hullian school, is free of discontinuities except under the most extreme circumstances.

Psychologists emphasize the tendency of individuals to adhere to the familiar, the customary and well-established standards for the

[7] Miller, George A., *Language and Communication*, McGraw-Hill Book Company, 1951. Miller has made considerable use of the 'redundancy' concept in research work, as reported in lecture series, although the term does not figure as prominently in his book.

[8] Shubik, Martin, 'Information, Risk, Ignorance and Indeterminancy', *Quarterly Journal of Economics*, Vol. LXVIII, 1954, pp. 629-40. Shubik suggests that 'a tentative name . . . for the ability to make decisions under conditions of low information is "selective intuition".'

regulation of their conduct. Behavioral guideposts are short-run, tangible and concrete factors.

In the absence of clues to the meaning of a particular situation, individuals tend to improvise them. Perhaps the best known demonstration of this tendency is Muzafer Sherif's work of the 1930s. Sherif showed that in situations inherently without frames of reference, individuals tend to establish subjective standards of their own. Furthermore, Sherif showed that individuals in a 'group' situation generally alter these norms in the direction of group norms. Sherif's experiments indicate, that is, that in an ambiguous situation group judgment tends to structure individual estimates.[9] Investigation of the development of rumors demonstrates this tendency in a more complex social situation. Allport and Postman found that individuals tend to adapt ambiguous information to their own needs, this information being meanwhile considerably simplified and sharpened.

The relationship between an individual's opinion on a debatable issue and his estimate of the percentage of his immediate associates agreeing with him in this opinion is certainly worth study for its bearing on investment decisions. Where intra-group relationships are more or less casual, there is some tendency for people to overestimate the percentage of the group sharing their opinion. (Educators may be interested to know that reactions of teachers generally seem to show somewhat the reverse tendency — indicating a perhaps justified bent toward a paranoid world-view.) A plausible hypothesis is that industrialists' estimates of the future are closely correlated with group estimates. There is some evidence, that is, that dominant group opinion tends to carry individual opinion along with it, until there is some clear-cut change. As Katona has expressed it in his *Psychological Analysis of Economic Behavior*, there is a 'time lag' necessary for new understanding of a changed situation. In Hullian terms, 'new understanding' is the result of the extinction of previous reinforcement. The 'bandwagon effect' deserves considerable further study in this connection, but the evidence argues against discontinuities in business expectations.

IV. EMPIRICAL INVESTIGATIONS OF BUSINESS EXPECTATIONS

P. W. S. Andrews has contributed a great deal to the description of firms' adjustment to changing demand, particularly in his *Manufacturing Business* (Macmillan, 1949). The most latent response to

[9] Sherif, M., *The Formation of Social Norms*, Harper & Brothers, 1936. Sherif studied individual reactions to the 'autokinetic' effect produced by observation of a pin-point of light in an otherwise completely darkened room. Sherif found that individuals perceive such light as being in motion, and actually establish individual and group norms for evaluating such perceived (but illusory) movement.

new orders, according to Andrews, is that of increasing plant capacity. Firms generally employ the devices of over-time, extra shifts, and alteration of existing equipment rather than engage in plant expansion. Hicks has noted this tendency in his treatment of working capital.

While the nature of the reaction to increased demand will vary with respect to the type of firm under consideration, there exists in all industries the same psychological basis for a cautious approach. For example, this description is not inaccurate in the field of public utilities. The writer had an opportunity to spend several weeks of a study period with one large public utility, and officers of this firm were quite frank about their investment plans and past investment actions. Even in such a firm, the effort to regularize investment was significant, and large projects for expansion of capacity were, and are, undertaken only after what seem to be the most clearly defined evidences of consumer demand. Likewise, Gort found in studying the electric power industry that while companies plan for three years ahead, definite commitments are made for only about a year in advance and even these can often be cancelled with little loss.[10]

More competitive industries contain similar examples of behavior of firms with respect to investment in capital plant and equipment. In the rubber products industry, for example, there is a long record of technological innovation and entrepreneurship of a classical nature. The rubber tire industry is a highly competitive field, as Lloyd Reynolds and others have noted. The hypothesis that firms attempt the most continuous investment policy possible, receives support from accounts of plant expansion in rubber industry trade journals (*Rubber Age* and *India Rubber World*) from 1920 to the 1950s.

Reports of plant expansion in the rubber industry were almost invariably accompanied by phrases such as: 'the firm has been operating with three full shifts, seven days a week . . . the firm has been unable to fill back-logs of orders . . . the firm was forced by expanding business to increase capacity' and similar statements. Some account must be taken, of course, of journalistic requirements dictating the form of these reports. However, with allowance for such constraints, these journals clearly indicate that reaction to a need for plant expansion is always a delayed and cautious one. Melvin G. DeChazeau, reporting in the *Regularization of Business Investment* on his direct investigation of the investment actions of firms of varying size and kind, noted that 'Short-term market

[10] Gort, Michael, 'The Planning of Investment: A Study of Capital Budgeting in the Electric Power Industry, I', *Journal of Business*, Vol. XXIV, 1951, pp. 79-95.

prospects had been important . . . not for economic but for psychological reasons. They were the catalyst that served to initiate investment undertaken for other reasons'.

This is consistent with research reported by Katona and Morgan on reasons for business expansion of plant.[11] Katona and Morgan found, in a survey of reasons for plant expansion, that the two most important factors were current demand and cost-efficiency considerations. Joel Dean's extensive empirical work in the field of business behavior leads him to conclude (in his contribution to the volume on *Regularization of Business Investment*, pp. 62-3) that uncertainty 'blows up the importance of the near future and discounts the distant future heavily'. Dean's conclusion is that uncertainty thus 'is a major cause of cyclical fluctuation of investments and is a major barrier to alteration of their time pattern'. In terms of the frame of reference assumed in this paper, the tendency to overemphasize the near future can be interpreted as a factor making for continuous investment action. However, such preoccupation with the present may aggravate the business cycle, as Dean suggested and as will be noted below in the special case of money-panics.

There is, then, evidence that firms do not ordinarily exhibit discontinuities of investment behavior, especially under present conditions of cash accumulation. Most firms today have clearly institutionalized practices of automatically appropriating depreciation funds and a portion of retained earnings for expansion purposes. These funds are generally matched against requests for capital projects submitted by department heads. Firms do not, apparently, attempt to 'lead' the business cycle or make radical adjustments in their capital equipment, as would be the case under conditions appropriate to non-linear responses described by Goodwin and Hicks.[12] Firms proceed as if 'tomorrow' will be a simple projection of 'today'.

Firms certainly adjust to changing demand, but not to the extent of dropping to a zero level of new investment or of jumping to a maximum possible investment. Their investment decisions are best described as a function of revenues in the recent past (last fiscal period), technological improvements and new products, depreciation reserves and available cash, and pressure of back orders on present

[11] Katona, George and Morgan, James N., 'The Quantitative Study of Factors Determining Business Decisions', *Quarterly Journal of Economics*, Vol. LXVI, 1952, pp 67-90.

[12] Cf. Ferber, Robert, 'Measuring the Accuracy and Structure of Businessmen's Expectations', *Journal of the American Statistical Association*, Vol. 48, 1953, pp. 385-413. This conclusion is substantiated in various reports in the *Regularization of Business Investment*, and is consistent with views expressed by several officials of Akron rubber firms in interviews carried on by the writer in 1953.

capacity.[13] The view expressed here is consistent with the results of more generalized behavioral studies — discontinuities are rare and investment decisions are ordinarily made with a view to adjustment to the total environment, so that the life of the firm will be reasonably coherent, and integrated.[14]

V. MONEY PANICS AND NON-LINEARITY

The exception to this generally continuous movement in the expansion of plant capacity is to be found in a period of financial crisis. Executives exhibit a fairly high degree of 'anxiety' about possible financial disaster, and wisely so, of course. Money panics have always inflicted hardship. For example, firms in the rubber industry have often been holding high-priced inventories during a period of falling prices and tightening credit terms. Such occurrences have resulted in the financial collapse of even the largest firms and the immediate end of investment action for all firms for the duration of the crisis.

Executives in this industry indicated that firms plan carefully for at least a year ahead. They also can make rather accurate predictions for six months ahead with respect to their cash outlay and income, and even plan in some detail expansion through a three year horizon. However, there was agreement that should a panic occur, they could and would very quickly make what amount to discontinuous adjustments. Significantly, even in the case of public utilities, this seems to be true according to Gort and others.

The signals for retrenchment are clear, as is the manner in which it would be carried out. When 'goods are not selling' and 'money disappears' firms make extreme adjustments in a negligible length of time with respect to new investment in plant. One company constructed a new plant for rim production in 1920 but, with the onset of recession in that year, did not equip and utilize the plant until 1922. Data are available in company archives relative to this and other plant expansion. Executives in various firms emphasize the speed with which firms abandon projects if they appear to be financially impracticable, even though considerable sums of money have been previously invested in the projects. These actions constitute discontinuities under even a strict definition of the term. The sum of

[13] Cf. Taitel, Martin, *Profits, Productive Activities, and New Investment*, TNEC Monograph No. 12, 1941, where it is argued that new investment is a function of technology and sales rather than profits.

[14] This is at least a partial answer to the Harrod-Kalecki-Domar school, as summarized by Levitt, and their concern for the dearth of investment opportunities accompanying capital growth. See also Kaldor, Nicholas, 'The Relation of Economic Growth and Cyclical Fluctuations', *Economic Journal*, Vol. LXIV, 1954, pp. 53-71.

such adjustments produces a non-linear curve of investment action through time.

The 'trigger mechanism' comes, in the light of this analysis, from outside the entrepreneurial center, and is located apparently in the domain of more purely financial interests. In terms of the oscillatory process, the key phase of the inter-couplings is that of 'money panic' or war. The system suggested here thus minimizes the role of under-capacity or overcapacity in creating discontinuities — unless these maladjustments are of an external nature.

VI. SUMMARY AND CONCLUSIONS

Business expectations are such that, except for money panics, points of discontinuity in investment action are not likely to develop. Yet there are indications that non-linearity has characterized the movement of national income in the United States. There have been many abrupt changes in the economy during the last half-century and these may certainly be interpreted as discontinuities or non-linearity. Further, a recent empirical study by G. H. Fisher of the propensity to consume and the accelerator indicates that they had values leading to 'explosive' behavior in aggregate real income.[18] Such behavior is postulated in Hicks's model and becomes, with his assumptions of a 'real' ceiling on expansion and technical limitations on disinvestment during contraction, a non-linear cycle. However, if business expectations are not ordinarily such that a non-linear cycle will ensue, as this paper suggests, then a more plausible explanation of this behavior is that it reflects the summation of psychological reactions to money panics, viz. those of 1920 and 1929. These might be termed psycho-pecunic factors if a new term is needed, or in ordinary terminology the disappearance of business confidence.

The available evidence concerning decision making of professional entrepreneurs is inconsistent with the square wave of income described by the non-linear cycle in Goodwin's theory. Financial panics, however, may induce such action. In a 'musical chair' economy, as described by Keynes, rates of investment at a zero or maximum level are perhaps the only alternatives. In an economy characterized by the presence of corporations able to collect capital funds through depreciation allowances and retained earnings, such

[18] Fisher, G. H., 'A Note on Mr. Harrod's Dynamic Model', *Southern Economic Journal*, Vol. XIX, 1953, pp. 334-8. Fisher shows that, on the basis of estimates of gross national product from 1920 to 1941, there is some evidence that the propensity to consume and the accelerator had values leading to 'explosive upward' behavior in aggregate real income. See, however, another earlier view by Fisher, 'A Simple Econometric Model for the U.S., 1947-50', *The Review of Economics and Statistics*, Vol. XXXIV, 1952, pp. 46-8.

rates are very special cases. The only situations in which the 'saturation value' of the investment mechanism is reached are those of financial panic on the one extreme or perhaps war on the other.

The view presented here asserts that entrepreneurial investment decisions do not, in most situations, contribute to a non-linear cycle. The evidence seems rather to favor the idea that entrepreneurial decisions would generate an orderly economic growth were they not impaled by periods of monetary stringency and war emergencies. Contrary then to Hicks's view of the money factor, it would seem that psychological reactions to money crises *are* the key to the most significant business cycles experienced by Western economics. It may be true, as Hicks remarks, that a 'cycle . . . can be explained in terms of simple reactions, which are not in any mysterious sense psychological, but are based on the technical necessities of a capital-using economy'. However, observation of the behavior of professional entrepreneurs indicates that monetary factors are responsible for most points of economic discontinuity, i.e. the non-linear cycle.

COE COLLEGE
IOWA

THE BIRTH AND DEATH OF INDUSTRIAL ESTABLISHMENTS: EXPERIENCE IN THE WEST MIDLANDS CONURBATION[1]

by MICHAEL BEESLEY

THIS article has three purposes — to call attention to a rich source of information about industry which has hitherto been relatively neglected, to use evidence drawn from this source to support a particular hypothesis about the influence of different types of industrial structure on the emergence of new enterprise, and to point out some of the potentialities of the source for further industrial research.

The Nature of the Material Used

The material drawn upon here comes from the registers of H.M. Inspectors of Factories.[2] The Inspectors keep a running record of establishments subject to the provisions of the Factories Acts. The field covered is broadly that of manufacturing industries and those service or residentiary trades, such as garages, bakeries, and shoe repairers which use power. The records give the name of the firm operating the establishment, its activity and numbers employed when last visited. In the case of most establishments, visits are at least once yearly; some small establishments are, however, visited every two years. The number employed refers to the operatives within the establishment, and thus excludes office and administrative staff. The activity is usually recorded in detail — by product where appropriate, by process where products are many and quickly changing. As the records are kept by streets, any area may be selected for analysis. Records are kept up to date as visits occur; past figures of employment are erased, but the existence and activity of establishments in past years can be traced. The registers, which run for eight years, thus yield information about employment only when the registers are finished, but the other information entered in the period can be seen.[3]

[1] The author wishes to acknowledge his debt to the Board of Trade, whose financial support for work on the location of industry, under the auspices of the Clay Committee, made this research possible.

[2] Mr. Bramley-Harker, H.M. Superintending Inspector of Factories, South Midlands Area, and Miss I. M. S. Keeley, lately Superintending Inspector of Factories, West Midlands Area, very kindly put the registers at the disposal of the author.

[3] In the F.I. records, the 'establishment' differs slightly from the establishment of the Standard Industrial Classification, 1948. It is similar in that, as with the S.I.C. 'in the majority of cases an establishment will comprise the whole of the premises under the same ownership or management at a particular address' and 'an establishment is classified according to the nature of its major product'. But the F.I. data does not always give separate information for those departments at one address which are recognized by the S.I.C. On the other hand, where there is a right of way between buildings at one address, the F.I. data will show them separately, whereas the S.I.C. may not recognize the separation. These differences occur infrequently, however.

The detailed information in the registers enables one to aggregate data on establishments in a way appropriate for the particular purpose on hand. Equally important for the present work, there exist in many offices registers going back over a number of years. The entry and exit of establishments in different geographical areas may thus be traced. Because only a running record of employment is kept, one cannot usually find the size of the establishments entering or leaving the registers, and it became a general rule for the Inspectors to record employment only in the middle 'thirties. Since, however, the vast majority of establishments concerned in these changes are known to be very small (some evidence to support this will be given later), and are usually owned and operated by single firms, the registers do give by implication a great deal of information about small firms. (For some purposes the bare facts of the dates of entry and exits of establishments would of course be valuable.)

The registers yielding most of the material upon the 'births' and 'deaths' of establishments used in the present article were discovered in the course of a wider study of the inter-war development of industry in the West Midlands Conurbation — that agglomeration of urban areas of which Birmingham C.B. is the chief constituent.[4] They covered the years 1923-38, and related to two areas which are here designated the 'N.W. zone' and the 'S.W. zone' of the Conurbation. These were industrial areas including Wolverhampton C.B. and Dudley C.B. respectively. The numbers of workers in 1938 covered by the registers in each zone were 48,749 and 24,123.

The occasion to use the registers to trace births and deaths arose when the author wished to test an hypothesis, derived from earlier work in the study, about the effect of differences in the structure of the industries of the zones upon the emergence of new establishments therein, and the latter's effect, in the long run, on employment in the zones. As the interest of the present article lies in demonstrating how a little used source of data may be used for industrial investigation, the author will not stay to detail the evidence which led him to make his hypothesis, but will merely state it in the next section and then proceed to bring the evidence from the registers to bear upon it. The hypothesis concerns certain general characteristics of the chief industrial activity of the zones — the metal and metal using industries. The evidence upon births and deaths thus principally concerns this aggregate of industries, rather than individual industries. We had, in the event, too few observations in any case to be able usefully to analyse the births and deaths in individual industries. Data on

[4] This study has recently been completed and sent to the Board of Trade for consideration by the Clay Committee.

births and deaths in two other categories of industry — 'Other Manufacturing' and 'Residentiary' industries (i.e. industries serving the resident population of the zones) is also presented. The three categories of industries include the whole of the establishments covered by the registers. Working with aggregates instead of individual industries of course presents some difficulties in interpretation which we attempt to meet.

The Effect of Differences in Industrial Structure on the Emergence of New Establishments

We should first define the term 'structure'. In the present context it is taken to mean the specialization of each zone to various stages in the productive sequence of metal industries. Thus, in the study mentioned earlier, we distinguished between four major stages: (1) Early manufacturing and forming processes (for example, iron and steel and non-ferrous metal rolling and drawing); (2) Later forming processes (for example, stamping, piercing and forging semi-finished metal to make finished goods or parts for further assembly); (3) Sub-assembly (bringing together parts to go forward for assembly), and (4) Assembly (of complete articles).

By comparing the structures of the two zones, and drawing upon evidence elsewhere in the study, the author was led to formulate the following hypothesis: There was, he argued, in the inter-war years, a 'virtuous' circle in the N.W. zone which the S.W. zone lacked, and which favoured new enterprises. The major differences between the zones were that the S.W. lacked the sub-assembly activities of the N.W. zone, and, more important, that there were marked differences within Stages (2) and (4). The N.W. zone assembly industries (at Stage 4) were markedly more complex, that is, they drew their supplies of parts from many more local suppliers than did the S.W. assembly industries, and in the later forming processes (of Stage 2), the plant and machinery employed was less specific in the N.W. than in the S.W., that is, it was more adaptable to the production of new components. Also, there was a wider variety of metal working processes. There was, in fact, a complex of juxtaposed and interdependent processes in the N.W. zone which was also characteristic of another part of the Conurbation — Birmingham — but which was largely absent in the S.W. zone. These circumstances implied a higher degree and wider variety, of metal working skills in the labour force. The combination of non-specificity in investment and high skill created an environment favouring experimentation with new combinations of parts to form product innovations. This opportunity to combine parts represented an incentive to form new enter-

prises, which were reflected in the creation of new establishments in two ways — by new firms whose entrepreneurs would break away from established firms and by the setting up of branch establishments by existing firms. These new establishments represented additions to the assembly stage of production in the N.W. zone. Some of them grew; then growth gave opportunities for sub-contracting parts and thus a further stimulus to the emergence of part making enterprises. Growth in the production of an assembled article implied some change in the character of the product, and thus created opportunities for fresh types of components which an area with predominantly non-specific investment in the 'later forming' stage of production could turn to making. Hence there tended to be a constant enrichment of the variety of parts made which in turn created the conditions for new combinations in assembly.

This hypothesis raised the expectation that, over a fairly long period, more new establishments would have been set up in the metal industries of the N.W. zone than in those of the S.W. zone. The author was thus interested in both birth and death ratios of establishments, and also in the effect of different ratios of surviving new establishments upon the employment in metal industries afforded in the two zones. The registers for 1923-38 gave the opportunity to check on the hypothesis and upon the effects on employment.

Evidence of 'Births' and 'Deaths' of Establishments

Before presenting the data, we must examine in some detail the implications of 'birth' and 'death' ratios of establishments for the inquiries just set out. First, since we are concerned with the formation and survival of *establishments*, we must be certain not to confuse mere changes in ownership of establishments with the 'birth' and 'death' of establishments. The unit of ownership and the firm may change, for example, by sale or merger without implying formation or dissolution of the establishment, and our data are treated accordingly. (This means that our data do not directly provide evidence about 'births' and 'deaths' of firms. In practice, the *aggregate* rates we shall construct probably provide a fairly close approximation to the 'births' and 'deaths' of *small* firms. Most of the establishments included in the ratios are very small and must have been for the most part owned and operated by independent firms, and the small firm and the small plant are closely bound up in life as in death. But the distinction is of great importance in considering effects on employment, for a few individual establishments might well provide a large part of the change in total employment, and here it is essential to eliminate the element of ownership.)

Second, we must consider what is implied by a 'birth' or 'death' ratio of establishments in an area. A 'birth' or 'death' ratio is expressed by computing the proportion of the number of 'births' or 'deaths' to the total industrial 'population' of establishments. A given area may gain industrial population from two sources — establishments which are new formations from within its existing industries — 'natural births' — and establishments which are transferred from outside the area — 'immigration'. Similarly, an area may lose industrial population by the dissolution of the establishment — 'natural deaths' — or by removal elsewhere — 'emigration'. In old established industrial areas such as we are considering, by far the greater part of gains and losses will be due to formations and dissolutions within the area's industries, i.e. natural 'births' and 'deaths', for, as we have noted, the vast majority of gains and losses consist of very small establishments and they are known to be exceptionally immobile.

Now, by examining the 'birth' ratios for two areas over a given period, and by finding what we may call the 'infant mortality' rates of the new establishments, we may find that there is a tendency in one area for more new establishments to be born and to survive than in the other area. But in the short run, the effect upon employment of the successful launching of new small establishments must be negligible, for they represent mainly transfers of employment from one establishment to another. The most usual way to start a new establishment is for a man who has been working in a local firm to gather one or two of his work-mates and break away. An area in which more of these successes occur may thus gain less in employment in the short run than another area which has fewer such successes but which has, for example, larger reserves of labour to attract a few large enterprises from outside the area. The significance of a higher success rate is that it is a form of insurance for the employment in an area in the long run. A few of the new small establishments will grow, and will be able to absorb resources falling into disuse in the area. The more indigenous new enterprises an area has, the less it is dependent on the stimulus of enterprise from outside. Many new products which eventually command a wide market are first produced on a very small scale by 'break-aways' from existing industries. The more new establishments an area has, the greater are the chances for such developments to occur, and the better are its prospects for keeping in the van of industrial change.

We may now present the evidence about the 'births' and 'deaths' of establishments in the two zones. The old registers enabled us to do

two things: to trace the entry and exit of establishments back to 1923, and to determine the age-structure of establishments in existence in 1938 in so far as they entered after 1922. The terms 'entry' and 'exit' are used in preference to 'birth' and 'death' since transfers of establishments from and to other areas could not be identified. As we noted earlier, the great majority of establishments included in the entry and exits data are very small and must have been true 'births' and 'deaths'; for practical purposes, the ratios we shall present are actually 'births' and 'death' ratios, but the terms 'entry and' 'exit' are used to save confusion. The Factory Inspectors visited establishments at least once in every two years, and in most cases more frequently. There may thus be a lag of up to two years in the recording of an 'entry' or an 'exit'.[5] This lag is of little or no importance in total figures stretching over 16 years, but makes the figures for individual years rather speculative.

We deem an establishment to have 'entered' an area when an establishment, newly formed, is visited for the first time at a given address. In such a case, the establishment is recorded in the registers as having its 'first visit'. But 'first visits' as recorded include some cases which do not satisfy the criterion of new formation to which we wished the data to conform as far as possible. Thus we had to exclude the following cases of 'first visits' — changes of name of firms at a given address without changes of products, i.e. we excluded mere changes of ownership; cases where establishments had power for the first time (it was the practice before the war for these cases to be erased from the 'non-power' register and entered in the 'power' register); and cases where establishments were transferred from one part of the zone to another. The latter cases could be recognized by finding a corresponding 'exit' from another part of the zone at the same time as the supposed 'entry'. Our 'entries' include, on the other hand, a few transfers from outside the zone (the very occasional transfer between the S.W. and the N.W. zones being eliminated); cases where there was apparently continuity of occupation of an address, but where there was at the same time a change of name of firm *and* product (usually in such cases of a double change a distinct gap in visits occurred): and branch establishments of firms already in the zone.

The rules for counting 'exits' were the converse of the 'entry' rules; the criterion is the closing down of an establishment and the dispersal of its labour force. Thus we excluded from this category

[5] The lag in recording means also that some Establishments might complete their cycle of birth and death without being recorded at all. This is an irremediable defect, but a small one.

transfers within the zone; the very rare cases of an establishment abandoning its power; and changes of product without changes of name, or vice versa. 'Exits' *included* establishments changing product and name at the same time at the same address, transfers from the zone, and branch establishments closing down.

Starting with the total population of metal establishments at the end of 1938 in each zone, we calculated, by adding the year's exits, and subtracting the entries, a figure representing the total population at the beginning of 1938. Similar calculations yielded a total population for the beginning of each year back to 1923. (These are approximate because of the possible lags in recording described earlier.) The entries for each year were divided into those which survived to 1938, and those which did not. The 'exits' for each year were divided between those which had entered some time during 1923-38, and those which entered at some time before 1923. These data are entered in Table I. At the foot of the column for each year a figure is entered which represents the percentage of the total population at the beginning of the year that the year's entries and exits represent. In the 'Total' column, the average of these yearly figures is given.

The averages show that there was a somewhat higher rate of 'exits' in the N.W. than in the S.W., and a markedly higher rate of 'entries' in the N.W. We cannot interpret these figures directly as supporting our hypothesis about a higher rate of successful entries in the N.W., however, as on the one hand, many of the entries in both zones occur in the years 1935-38 and there was little time, as it were, for deaths among them to appear in the data, and on the other, the 'exits' contain a large proportion of establishments of uncertain vintage. And the total population was constantly changing.

To come closer to the question of successful entry, we may first devise a satisfactory ratio for entries. This is done by calculating the proportion which entries, both surviving and non-surviving, over the entire period 1923-38 (ES + ENS) are of the total population at 1923 (P1923) plus those entries. Thus the calculation is

$$\frac{ES + ENS}{P1923 + ES + ENS.} \quad \frac{ES + ENS}{P1923 + ES + ENS}$$

for the S.W. zone is .280; for the N.W. zone .392. Since the number of observations is, especially in the case of the S.W., small, we must test these results for significance, taking the null hypothesis in the proportions test. The difference between .280 and .392 is .112; the standard error of the difference in proportions between two samples of $n_1 = 442$ (S.W.)

TABLE I

ENTRY AND EXIT OF METAL ESTABLISHMENTS, 1923-38

	1923	1924	1925	1926	1927	1928	1929	1930	1931	1932	1933	1934	1935	1936	1937	1938	*Total*
S.W. Zone																	
Total population	*318*	*317*	*310*	*301*	*300*	*300*	*30*	*301*	*303*	*279*	*271*	*264*	*259*	*256*	*248*	*246*	*242*
Entries																	
1938 Survivors	3	5	3	2	4	4	6	7	1	4	1	3	4	8	5	12	72
Non-Survivors	3	3	3	5	5	12	3	5	1	1	5	5	—	1	—	—	52
Total Entries	6	8	6	7	9	16	9	12	2	5	6	8	4	9	5	12	124
Exits																	
Entrants 1923-38	—	—	—	—	—	1	3	6	11	2	2	5	3	5	6	8	52
Others	7	15	15	8	9	9	11	4	15	11	11	8	4	12	1	8	148
Total Exits	7	15	15	8	9	10	14	10	26	13	13	13	7	17	7	16	200
Per Cent Total Population																	*16 yrs. av.*
Total Entries	*1.9*	*2.5*	*1.9*	*2.3*	*3.0*	*5.2*	*2.9*	*4.0*	*0.7*	*1.8*	*2.2*	*3.0*	*1.5*	*3.5*	*2.0*	*4.9*	*2.71*
Total Exits	*2.2*	*4.7*	*4.8*	*2.7*	*3.0*	*3.3*	*4.6*	*3.3*	*8.5*	*4.6*	*4.8*	*4.9*	*2.7*	*6.6*	*2.8*	*6.5*	*4.38*
N.W. Zone																	
Total Population	*478*	*466*	*459*	*442*	*445*	*432*	*433*	*439*	*420*	*420*	*411*	*416*	*403*	*408*	*418*	*422*	*415*
Entries																	
1938 Survivors	6	6	9	6	6	6	14	6	6	10	18	7	13	23	27	19	182
Non-Survivors	8	11	17	18	7	14	6	8	6	9	5	4	8	3	2	—	126
Total Entries	14	17	26	24	13	20	20	14	12	19	23	11	21	26	29	19	308
Exits																	
Entrants 1923-38	—	—	4	5	8	4	7	16	5	13	8	12	9	9	12	14	126
Others	26	24	39	16	18	15	7	17	7	15	10	12	7	7	13	12	245
Total Exits	26	24	43	21	26	19	14	33	12	28	18	24	16	16	25	26	371
Per Cent Total Population																	*16 yrs. av.*
Total Entries	*2.9*	*3.6*	*5.7*	*5.4*	*2.9*	*4.6*	*4.6*	*3.2*	*2.9*	*4.5*	*5.6*	*2.6*	*5.2*	*6.4*	*6.9*	*4.5*	*4.47*
Total Exits	*5.4*	*5.2*	*9.4*	*4.7*	*5.8*	*4.4*	*3.2*	*7.5*	*2.9*	*6.7*	*4.4*	*5.8*	*4.0*	*3.9*	*6.0*	*6.2*	*5.34*

and $n_2 = 786$ (N.W.) is 0.028.[6] The observed difference is four times the standard error, and thus may be regarded as highly significant. This shows that there was a tendency for a higher incidence of entries in the N.W.; but what of the survival of those entries?

We may perform a similar calculation to show the ratio of 'surviving' entries, i.e. those which survived at least till 1938. This is $\frac{ES}{P1923 + ES}$. For the S.W., the ratio is .185; for the N.W. .276. Testing for significance as before, we find that the difference, .091, is more than three times the standard error of the difference in proportions (.027) and is thus also highly significant.[7] In view of the result of the first calculation, this is not surprising, and because of the number of entries in the late 'thirties, we should, it seems, supplement this result by considering the 'infant mortality' of entries for which we have useful data. We may therefore consider the entries for the years 1923-29 in each zone, and calculate the proportion which failed to survive for nine years, i.e., till 1938. In the S.W. zone there were 58 such entries: 27 or 45.5 per cent failed to survive nine years. In the N.W. zone there were 134 entries, of which 67 or 50 per cent failed to survive. (The life of particular establishments had to be traced in the basic data — the proportions cannot be calculated from Table I.) On this evidence, the chances of survival for nine years of entrants in each zone were not markedly different. A similar result may be obtained by calculating the proportion:

$$\frac{\text{entrants 1923-34 inclusive who survived to 1938}}{\text{entrants 1923-34 inclusive who failed to survive to 1938 plus numerator.}}$$

Here, we cut out the entrants (1935-38) amongst whom exits might

[6] The calculations in detail are as follow: $\frac{ES+NS}{P1923+ES+NS}$ in the S.W. $= \frac{124}{442} = .280$ In the N.W. the corresponding calculation is $\frac{308}{786} = .392$. Proportion of entries for combined samples (p) $= \frac{432}{1228} = .355$. Standard error of difference in proportions between two samples $n_1 = 442$ and $n_2 = 786$ is $= \sqrt{pq\left(\frac{1}{n_1} + \frac{1}{n_2}\right)} = \sqrt{.355 \times .645\left(\frac{1}{442} + \frac{1}{786}\right)} = 0.028$.

[7] The detailed calculations are as follow: $\frac{ES}{P1923+ES}$ for S.W. $= \frac{72}{390} = .185$. For N.W.: $\frac{182}{660} = .276$. Proportion of entries for combined samples (p) $= \frac{254}{1050} = .242$. Standard error of difference in proportions between two samples $n_1 = 390$ and $n_2 = 660$ is $\sqrt{pq\left(\frac{1}{n_1} + \frac{1}{n_2}\right)} = \sqrt{.242 \times .758\left(\frac{1}{390} + \frac{1}{660}\right)} = .027$.

be expected to be potentially highest. This calculation yields .468 for the S.W. and .469 for the N.W. Again there is virtually no difference in proportions of survivals.

Our conclusion is that there was a significantly higher ratio of entries in the metal industries of the N.W. than in the S.W., and that, as the proportion of survivors among the establishments that entered was, so far as the evidence takes us, roughly equal in both zones, the N.W. had a higher ratio of 'surviving' entrants in the total population of establishments.

That there is little difference in the chances of survival of entrants in each zone should occasion little surprise. Such studies of the mortality of small firms as are available stress that factors in mortality common to all firms are the most important — such as ignorance, incompetence of the entrepreneur, lack of effective book-keeping, lack of capital, and so on. For example, the T.N.E.C. monograph on *Problems of Small Business*, the most comprehensive summary of American data on business mortality available, summarizes the evidence thus: 'Establishment of a concern and entrance of an individual into business are usually accompanied by the naive optimism of inexperience. Unaware of the odds against them, and largely ignorant of the weapons of trade, prospective proprietors march stolidly into the ambush . . . (Mortality) is not a new experience, nor is it primarily a phenomenon of cyclical depressions. A descriptive phrase which might indicate the persistence of business dissolution is the stability of mortality. Some variation occurs in different sections of the country, in different fields of business and under changing business conditions, but the long-time trend of disillusionment is impressively constant.'[1] There is little evidence in Table I that exits are correlated with boom and depression, when one allows for the possibility of a two-year lag in the figures; there are, it is true, some signs of a cluster of exits in the S.W. in 1931-33, but little or none in the N.W., where the largest cluster seems to appear in the middle 'twenties. Nor is there much sign of such a correlation in respect of entries. 'Proprietors marching stolidly into the ambush' is perhaps a fitting description of our data.

The difference in the incidence of successful entry of establishments in the N.W. and the S.W. was confined very largely to the metal industries of the zones. This may be confirmed by considering the category 'Other manufacturing industries'. (These were industries

[1] T.N.E.C. Mono. No. 17. *Problems of Small Business*, Washington, 1941, p. 3. It is perhaps a fair comment that the data presented in that monograph compares unfavourably, on the whole, with the data used in the present study. A great number of the studies on which the authors of the monograph draw relied upon city and trade directories, and there is nowhere evidence of such reliability as our Factory Inspectors' reports.

which, by contrast with metal industries, were unlocalized.) By similar processes to those just performed, we find that in 1938, the N.W. zone's population of establishments in this category was 254; in 1923 it was 260. The corresponding figures for the S.W. zone were: 1938, 164; 1923, 181. Entrants in 1923-38 in the N.W. surviving to 1938 were 118; non-surviving entrants totalled 87. For the S.W., the figures were 75 and 45. The calculation $\frac{ES + ENS}{P1923 + ES + ENS}$ applied to each zone for 'Other manufacturing' yields: S.W. .400; N.W. .442. The further calculation $\frac{ES}{P1923 + ES}$ for the proportion of surviving entrants yields S.W. .293 and N.W. .312. The differences between these proportions are so small that they may easily have arisen by chance, and we conclude from this that the N.W. zone's superiority in respect of metal industries was due to factors arising in the metal industries alone and not to factors affecting all manufacturing in the zones.

As we noted earlier, working with material on aggregates of industries presents obstacles to interpreting our results as support of the hypothesis about the effect of differing structures upon entry. Our original argument emphasized the innovating possibilities of the N.W. structure. We could not separate the 'innovating' establishments in the data from the rest, and it might well be argued in the first place that, as the metal industries are aggregates of separate localized industries, aggregate ratios for entry and survival for the two zones may simply reflect the course of demand for the products of the separate industries. Thus it might be the case that demand for the products of the S.W. zone's collection of established localized industries was so much greater than that in the N.W. zone, that, in the period for which data are available, the effect on entry and survival of establishments of the particular characteristics of the structure we have singled out would be swamped, in the aggregates, by growth in localized industries.

Though we cannot deal with this difficulty directly, we have some indirect evidence that the stimulus to entry and survival of establishments provided by established localized industries was very probably less in the N.W. than in the S.W. zone. Thus in terms of insured employees, the percentage gains and losses in employment from 1924-37 in those metal industries recognized in the Ministry of Labour returns which employed 3 per cent or more of all insured employees at 1924 were as follows — in the S.W. zone, the total gain in employment was 14 per cent, and the total loss 3.1 per cent;

in the N.W. zone the respective figures were 6.2 per cent and 4.9 per cent. The net gain in employment in the zones were thus S.W. 11.9 per cent, N.W. 2.3 per cent. We may say that new establishments emerged in the N.W. zone in spite, rather than because of, the growth of demand for the products of localized metal industries.*

It might be argued, also, that this very adversity in the chief localized (assembly) industries in the N.W. zone would have precipitated a search for more profitable outlets for production and thus have contributed to the number of new establishments. Of course, if new establishments are to be formed, the resources must be available. If secondhand equipment and vacant factory space can be cheaply acquired, we have a general factor making possible their formation; and this factor was certainly present in the N.W. zone — but in the S.W. zone, too, as the high total death rates in both zones indicate (Table I). If the failure of the leading assembly industries provided a particular incentive to form new establishments, however, one would expect to see in the data signs of an access of new establishments at about or just after the time (1930-31) when the chief industries failed. Because of the difficulty in fixing precise dates of entry, one cannot be certain, but Table I does not seem to support this.

Many other possible contributory factors to the N.W. zone's favourable entry and survival record will doubtless occur to the reader. For example, the fact that there were proportionately more larger establishments in the N.W. zone's metal industries than in the S.W. zone's may have given the zone as a whole more experience of management techniques; and indeed the question of what circumstances are favourable to new entreprise in a locality raises many issues of history and social relationships. We have no evidence to offer on these points; they could best be tested by comparing experiences in many more areas than we have considered, and the collection of much more Factory Inspectorate data would make a thorough analysis feasible, and, the author believes, well worth while. Meanwhile, all we can conclude here is that it is at least highly plausible that the 'virtuous circle' in the N.W. zone's structure was a major factor in producing the higher incidence of entrants. The survival of those entrants, we concluded, was governed by general forces common to small firms.

* The areas covered by the M.O.L. data are wider than those covered by the F.I. data. Nevertheless, the figures quoted are a good indication of the shape of events in the respective areas. The outstanding feature of the inter-war period in the N.W. zone was the spectacular collapse of the motor car and motor cycle industries in Wolverhampton. In the early 'twenties, Wolverhampton was the third largest localization of the motor and motor cycle industries in the country. By the late 'thirties, not a single motor car manufacturer still remained in business. Famous firms like Sunbeam, Clyno, Star, Briton and A.J.S. closed down in Wolverhampton in the late 'twenties and early 'thirties.

TABLE II

S.W. ZONE OF CONURBATION — 1938 AGE STRUCTURE OF ESTABLISHMENTS

	Up to 4 years old (*Entered in 1934 and after*)		*5-15 years old* (*Entered between 1923 and 1934*)		*Over 15 years old* (*Entered before 1923*)		*All ages* (*Establishments and Employment at 1938*)	
	Establishments	*Employment*	*Establishments*	*Employment*	*Establishments*	*Employment*	*Establishments*	*Employment*
Metal	32	1,874	40	1,446	170	12,468	242	15,788
Other	33	868	42	741	89	5,512	164	7,121
Residentiary	30	255	30	414	64	545	124	1,214
Total	95	2,997	112	2,601	323	18,525	530	24,123

TABLE III

N.W. ZONE OF CONURBATION — 1938 AGE STRUCTURE OF ESTABLISHMENTS

	Up to 4 years old (*Entered in 1934 and after*)		*5-15 years old* (*Entered between 1923 and 1934*)		*Over 15 years old* (*Entered before 1923*)		*All ages* (*Establishments and Employment at 1938*)	
	Establishments	*Employment*	*Establishments*	*Employment*	*Establishments*	*Employment*	*Establishments*	*Employment*
Metal	89	2,543	93	5,484	233	28,335	415	36,362
Other	63	556	55	5,424	136	3,223	254	9,203
Residentiary	67	283	65	421	117	2,480	249	3,184
Total	219	3,382	213	11,329	486	34,038	918	48,749

The Effect of New Establishments on Employment

In addition to examining the hypothesis about structure, we were concerned to measure how much of total employment at 1938 was due to the formation of new establishments. The number of workers in each establishment in existence in 1938 was available, and we could identify each entrant between the years 1923 and 1938 by size at 1938 and approximate date of entry. The resulting age structure of establishments are presented in Tables II and III, divided into three categories, Metals, Other Manufacturing and Residentiary. Both the number of establishments and the number of workers are shown.

From these tables, the following percentages of total numbers of establishments and employment at 1938 in the three categories of industry due to the entry and survival of establishments at different dates may be worked out:

TABLE IV

PER CENT OF TOTAL NUMBER OF ESTABLISHMENTS AND EMPLOYMENT IN 1938 DUE TO: ESTABLISHMENTS ENTERING FROM 1934-38 INCLUSIVE

	S.W. Zone		*N.W. Zone*	
	Establishments	*Employment*	*Establishments*	*Employment*
Metals	13	12	21	7
Other Manufacturing	20	12	24	6
Residentiary	25	21	27	9
Total	18	12	24	7
(Actual total numbers at 1938)	(530)	(24,123)	(918)	(48,749)

ESTABLISHMENTS ENTERING FROM 1923-38 INCLUSIVE

	S.W. Zone		*N.W. Zone*	
	Establishments	*Employment*	*Establishments*	*Employment*
Metals	29	21	42	22
Other Manufacturing	45	22	46	65
Residentiary	47	55	53	22
Total	38	23	45	29
(Actual total numbers at 1938)	(530)	(24,123)	(918)	(48,749)

We have put forward an explanation of the higher rate of entry in the N.W. zone; it covered a series of particular cases of external economies peculiar to that zone and related to indigenous enterprises. External economies in existing industries may not, however, account fully or even principally for the appearance of establishments originating elsewhere. Thus we examined, as far as we were able, the antecedents of all new establishments employing more than 50 workers at 1938. (As explained earlier, the presence of a few large

establishments has an important effect on the total employment given by new establishments.) These investigations led us to interpret the main features of Table IV as follows—in 'Other Manufacturing' in the N.W. zone (1923-38), the high percentage of employment was due to the setting up, by firms located outside the zone, of large rubber and artificial silk plants in the 'twenties; and the bulk of employment given by new establishments in the S.W. zone in the metal industries in the period 1934-38 was due to the setting up of branch plants of firms originating in Birmingham. In both these developments, the principal factor attracting enterprise from outside was the presence of unused resources of unskilled labour — unemployed men, and more especially, women who could be drawn freshly into the labour force. In the N.W., on the other hand, the percentage of employment in metals (1923-38) appeared to owe very little to outside enterprise. The comparative youth of the establishments in the N.W. zone is of course a reflection of the higher incidence of successful entries.

The importance in the S.W. of the entry of a few large establishments in 1934-38 is also shown by calculating the share which establishments of 100 workers or more had in the total employment in metals at 1938 due to all entrants from 1934-38. In the S.W. these establishments provided 77 per cent of such employment; in the N.W. zone the relative figure was 32 per cent. Most of the surviving entrants of the period 1934-38 were still very small, however; in both the S.W. and N.W. zones, for example, over 75 per cent of the entrants in the metal industries employed 20 workers or less in 1938, which confirms our earlier assumption that most entrants were very small establishments.

In spite of the importance of a few large establishments entering in the boom period in the S.W. zone, it will be seen from Table IV that over the longer period from 1923-38, a slightly greater proportion of employment in metal industries in the N.W. zone than in the S.W. zone was due to new entrants (22 per cent as against 21 per cent). This, we may argue, tends to show that the fortunate circumstance for the S.W. zone, that in a time of boom it happened to have attractions for firms from an exceptionally prosperous neighbour wishing to employ large amounts of unskilled labour, was not enough to make up for its smaller propensity to breed indigenous enterprises in the longer run.

Further Applications of Factory Inspectorate Data

We conclude with a general comment on the significance of the type of analysis presented here. We discern in it, for example, a way

to construct one standard by which to judge the likelihood that any given industrial area will be able to sustain a long run growth of employment. The collection of Factory Inspectorate data for many different areas at the present time would enable one to calculate, as we have done for two areas for 1934-38, the incidence of successful entry of establishments and proportions of employment and establishments due to new entrants over various periods, say from 1945. From such recent records, it would be possible to make a firm distinction between births and deaths and migration. Comparison of a number of areas of different industrial characteristics might well yield some norm for the incidence of new establishments and the amount of employment to be expected therefrom. Such comparisons would need to consider 'births' and 'deaths' only. The progress of Development Areas towards self-sufficiency in creating enterprise could then be judged from the incidence of new establishments, and calculations of the amount of employment typically arising from them might serve as a forecast of demands for labour in a field where prediction has, up to now, been impossible. Collection of data for many areas would also make possible some most interesting and useful calculations of the births and deaths of establishments in individual industries which would be a marked improvement on the scarcity of information on this subject now available.

The standard by which to judge the progress of Development Areas would not necessarily be those of the two areas of the Conurbation we have considered, with their own peculiarities of structure and reserves of resources, and under pre-war conditions, when, for example, few administrative restrictions on location of new enterprise existed. But from our arguments about the advantages of the N.W. and Birmingham in breeding enterprise, it would hardly be surprising if similar calculations on post-war data for a number of areas showed them to be amongst the leading areas for indigenous new enterprises.

The author has been able to make calculations similar to those of Table IV for 11 wards of Birmingham, for the years 1934-38. He obtained old registers covering establishments employing 122,000 workers at 1938. The wards were most of the central wards of Birmingham, together with a few of the outlying wards. Thus nearly all the Jewellery quarter came within the area; it included major concentrations of small and medium sized metal working firms in Birmingham.[10] We have noted earlier that Birmingham shared the structural peculiarities of the N.W. zone's metal industries, and the

[10] The material covering the Jewellery quarter, included here, was used in the Working Party Report on the Jewellery industry as evidence about the birth and death of firms.

percentage of total number of establishments and of employment due to establishments entering from 1934-38 inclusive was, at 21 and 9, respectively, very similar to those in the N.W. zone at 21 and 7 (Compare Table IV).

Calculation for the same 11 wards in post-war data, however, enables us to make a much more interesting comparison. In the metal industries, 8.7 per cent of local employment, and 24 per cent of all establishments at the end of 1951 were due to establishments entering in the years 1947-51, the same number of years as for 1934-1938. The proportion of employment and establishments due to new entrants has not been very different in post-war years from what it was before. Thus areas like Birmingham may still be setting the pace for new enterprise, in spite of the official policy of restrictions on new branch plants and new buildings for existing firms, discouragement of firms who wish to move to Birmingham, and the attempted dispersal of new enterprise from such a congested centre. (Occupation of old buildings is still possible, which no doubt accounts for the high indidence of new establishments.) But these post-war figures need to be set against similar calculations for other areas. We may have demonstrated that the work involved would be well worth while, even though the present author has not been able to undertake it.

UNIVERSITY OF BIRMINGHAM

PRICE POLICY IN A NATIONALLY ADMINISTERED INDUSTRY — AN ALTERNATIVE VIEW

by David Gordon Tyndall

Two articles appeared in the November 1952 issue of this journal: Fred Stones, 'Price Policy in a Nationally Administered Industry', pp. 32-42, and Robert Shone, 'Steel Price Policy', pp. 43-54. They both dealt with the same problem, the pricing of steel by Britain's nationalized steel industry, and dealt with it in a practical, down-to-earth way, with direct reference to Britain's post-war problems, the availability of data, etc. etc.

It has been my feeling that both articles would have benefited greatly had they reflected more directly the results which economic theory has developed. What follows is a belated attempt to provide a few supplementary and emendatory thoughts on this issue. Nothing which I have to say is strikingly original or profound, but it seemed desirable to say it in order to complete and correct the picture left by the earlier articles.

In the first place, any analysis of the problem of price policy in a nationally administered industry must be based on (1) a postulate regarding the goal or goals which are relevant; and (2) the nature of the economy, domestic and international, in which the industry operates. For analytic purposes it will be useful to make certain simplifying assumptions with regard to the environment, but if the results are to be useful, the effect of relaxation of these assumptions must be considered.

At the outset we shall assume that the remainder of the economy is perfectly competitive and that the industry with which we have to deal is one of constant long-run costs. Under these conditions, long-run marginal cost equals average cost and, from the pure allocation point of view, price should be set so as to equal average cost; there is no basis for price discrimination within the domestic economy. We adopt the customary position of individualistic utilitarianism, and assume that private costs and benefits are identical with social costs and benefits, and that the automatic distribution of income which results from the competitive pricing process is ideal, or that it is rectified, where necessary, by fiscal devices which do not significantly affect the allocative force of the price system. We shall consider the problem of rational pricing in a situation in which there are widely differing degrees of efficiency within a nationalized, multi-plant industry.

When transportation costs are neglected, the solution to this

problem becomes relatively simple in principle. We must simply recognize that it is the marginal cost for the economy that is relevant[1] and that, *where capacity is being expanded or replaced*, marginal cost for the economy can be measured by the average cost (including a charge for depreciation, depletion and obsolescence, and a rate of return on capital equal to the market rate of investments of comparable risk) *of the newest plant*, computed at planned normal level of operations.[2] This will be referred to as 'standard cost'.

The costs in the newest plant may be greater or less than the standard costs of production in other plants, and it may be useful to consider briefly a few of the reasons for such differences and to show why our measure rather than some other is the correct one. We must first ask: What are the causes of differences in the standard costs of the several firms in an industry? There are many, but they can be classified for our purposes as follows:

1. Differences in acquisition price of similar plant or equipment due to general inflation or deflation of prices.
2. Differences in the productivity of plant or equipment due to differences in design which are not offset by differences in the cost of the plant or equipment. These may be due to either the development of improved plant or equipment at equivalent prices, or to differences in the layout, etc., of the plant and equipment when installed.
3. Differences in cost per homogeneous unit of any current input. Where substitution of input is possible, it may be difficult to distinguish between autonomous changes in cost per unit of input and the changes in technology which are induced thereby, and autonomous changes in technology and changes in the prices of inputs which are induced thereby. We shall show that it is not important, for practical applications, to be able to make this distinction in concrete cases.
4. Differences in the effectiveness of the combination of inputs which are not offset by differences in the compensation of the 'combiners' (top management).

It would be difficult in practice to draw a sharp line between the last two types of difference. E.g., if the cost of some essential raw material per unit of accepted *output* is greater due to the greater number of rejects per 100 units of the product in the one factory, is

[1] See A. P. Lerner, *The Economics of Control* (New York, 1947), *passim*.

[2] This generalization rests on the assumption (which will not always be valid) that no errors (beyond the normal, unavoidable minimum) were made in its design and location.

this due to differences in cost of labour or materials or to inefficient handling of men or material by management? It would probably be possible to devise tests to distinguish between these, but for present purposes no such distinction is required.

Differences in historical cost stemming from the effect of general inflation or deflation on cost of plant and equipment should not detain us long. It is now generally recognized that under these circumstances, historical costs are not representative of the real costs involved and, except where distribution of income considerations play a dominant role (e.g. in the contemporary 'rent on residential housing' question), should play no role in the determination of price. The result will be that old plants may show very handsome book profits following an inflation, but these book profits are no more than a reflection of the failure to value the assets on a replacement basis and the consequent understatement of economic depreciation. The consumers of the product have no legitimate complaint if the profits are used for eventual replacement of the plant and equipment. In the case of deflation, the old plants will show a small or negative profit, but this will place no burden on the taxpayer unless the investment was financed by bond issues. The revenues will be sufficient to provide for replacement of the equipment and earn a return on the deflated value of the equipment.

In the case of general inflation, it can be argued that the high profits which result from basing price on replacement costs are illusory. This is not true for technological changes. Society may lose in a very real sense if an important cost-reducing technological change occurs immediately after heavy investment in plant and equipment has been made. The loss would not have occurred if the investment had been postponed. But in our uncertain world, such losses are, in part at least, unavoidable. Our question is, should such losses influence pricing? Again the answer is clearly: no! Rationality requires that bygones be treated as bygones. If it is in fact economical to install the new plant and equipment, it is the marginal cost (which in this case equals the standard cost) using the new equipment which is the true measure of cost to society of the product, and it is by this cost that price should be determined. If the accounting records purport to show real values, the old plant should be written down — the loss should be recognized. But whatever the accounting convention may be, it is clear that the economic value has changed. The old figure can only be misleading.

Differences in standard cost also may be due to differences in the cost per unit of homogeneous input. Two principle cases may arise:

1. The latest plant may be located less advantageously due to technical limitations at the site of earlier plants (e.g., limited amounts of high grade ore). Again the standard cost of the new plant is the relevant measure. Only to the extent that the consumers are willing to pay a price sufficient to cover costs of production in the new plant should production take place. Again it is the fact that standard cost in the new plant equals marginal cost, that is the crucial determinant.
2. Due to new discoveries of ore, etc., it may be possible to locate the new plant more advantageously than the old. This is essentially a case of technological change and in this sense it has already been treated above.

Finally, there may be differences in cost due to differences in managerial efficiency in the various plants. One would hope that these would be small, but if they did exist, it might be rational to use an average of the *performance* of the various plants. Since every effort should be made to eliminate such differences by education and salary differentials, it would seem anomalous to use such differences as a basis for a pricing policy.

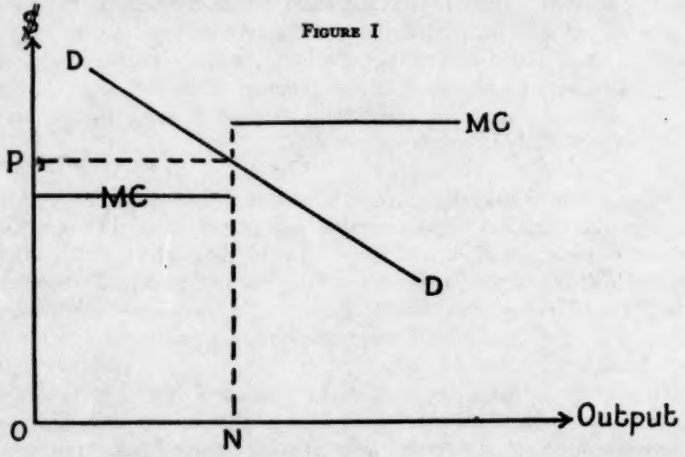
The foregoing analysis applies to situations where it has been possible to maintain capacity in line with current demand, i.e. where, at price equal to standard cost in the newest plants, demand can be met by operating new plants at planned normal, and operating old plants so that MC (marginal cost) = P (price). We must now consider situations where demand is greater or less than output under these conditions.

Where the demand cannot be satisfied under the stated conditions, this may be due to errors in forecasting demand, and the fact that time is required for creating new capacity , or it may be due to the fact that expansion or replacement of plant or equipment is limited by availability of capital, or it may be due to expectation that the increase in demand is short-lived (e.g., seasonal peaks). Whatever the reason, rationing of the supply must be carried out either by non-price means or by permitting price to rise to marginal cost. The second alternative will entail an expansion of output in all plants (except where there are discontinuities in the TC function at the earlier level of output). In the special case where there is a discontinuity in the total cost function such that there is no level of output at which P = MC, price should be set so as to exhaust the available supply, as shown in figure I below.

Where the product itself is exported or enters significantly as a cost of exports, use of marginal cost pricing may be decried on the

ground that it would seriously injure the country's competitive position in export markets. It should be clearly recognized that failure to price at marginal cost is, from a competitive economy point of view, subsidization of these export industries. This may be desirable, particularly where the situation is expected to be very short-lived, but it gives no warrant for choosing some average cost figure.

FIGURE I



The price decision should be made on its merits with respect to export considerations, recognition being given to the possible desirability of action to counter any undesirable secondary effects of this subsidy on domestic resource allocation.

Marginal cost pricing in this situation may also be criticized as being inflationary because of its effect on the costs of goods into whose production it enters, or because the resultant profits lead to demands for excessive wage increases by workers in that industry, which in turn leads to general wage increases, etc. etc.

If the economy is in a state of repressed inflation, this argument has merit; again the choice must be made between these dangers and the inefficiency in the use of resources which will result from failure to increase price. But under other conditions the first of these arguments will have no merit, since the 'inflationary' effects will be offset by equivalent deflationary effects as purchasing power is reduced in other markets. If workers are permitted to retain any notion that their wages should be a function of the profitability of the firms in which they work, there may be some danger in the effects of price increases on wages, but it should not be impossible to kill this unwarranted notion.

Where demand is *inadequate* at P = SC (standard cost in the newest plant), efficient allocation requires that price (and output) be lowered until demand equals output at P = MC. When cost functions are discontinuous, the relevant MC is the 'lowest one possible',

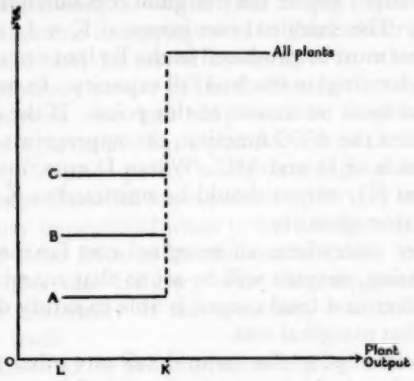


FIGURE IIA
Marginal Cost in Plants A, B, and C

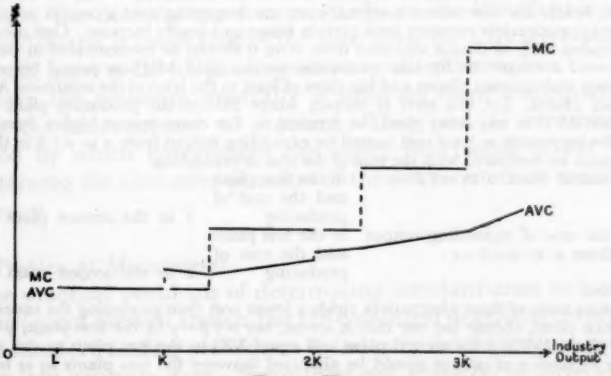


FIGURE IIB
Marginal Cost and Average Variable Cost for the Industry

i.e. the MC for the marginal plant, not necessarily MC in the newest plant. A geometric example may help to clarify the issue. Suppose we had three steel plants, A, B and C, whose AVC (average variable cost per unit of output) functions were similar in pattern except that plant A had lower AVC in the relevant range than B, and B somewhat lower than C, as shown in figure IIA. Then the aggregate MC and AVC functions have the form shown in figure IIB.

At outputs K and 2K marginal cost in the sense of rate of change

of total cost is meaningless, i.e. total cost is not differentiable. The marginal cost of the $K + 1^{th}$ (and of the $2K + 1^{th}$) unit is meaningful. It would be high owing to the necessity of shifting L (the minimum output in any plant) to B's (at $2K + 1$, to C's) high cost facilities. We have left a slight gap in the marginal cost function at K and 2K to indicate this. The marginal cost jumps at $K + L$, at which point additional output must be produced in the B plant since the lower cost of facilities of A have again reached full capacity. In our diagram the AVC reaches its local minimum at this point. If the demand function (D) intersects the AVC function, the appropriate price is given by the intersection of D and MC. Where D cuts through a gap in the AVC (e.g. at K), output should be restricted to K and the price set so as to sell that quantity.

In the simpler case where all marginal cost functions are monotonically increasing, outputs will be set so that marginal cost is the same in each plant and total output is able to satisfy demand at the price equal to that marginal cost.

We shall not attempt to discuss in detail any other possible forms of the cost function.[3] It does not seem possible to state anything

[3] In view of the frequency of its occurrence in the textbooks, it may be in order to mention briefly the case where marginal costs are decreasing over a certain range, then become approximately constant for a certain range and finally increase. Cost minimization requires that, as output increases from zero, it should be concentrated in the plant with lowest average cost for that particular output until MC has passed beyond the decreasing and constant phases and has risen at least to the level of the minimum AVC in the other plants. Let this level of output, where MC in the producing plant equals minimum AVC in any other plant, be denoted α. For every output higher than α, say $\alpha+\beta$, the increment to total cost caused by expanding output from α to $\alpha+\beta$ in the first plant, must be compared with the sum of the cost of expanding

output from α to $\alpha+\beta-1$	in the first plant and the cost of producing	1 in the second plant
the cost of expanding output from α to $\alpha+\beta-2$	in the first plant and the cost of producing	2 in the second plant

and so on.

If one or more of these alternatives yields a lower cost than producing the entire $\alpha+\beta$ in the first plant, choose the one that is lowest, say $\alpha+\beta-\gamma$ in the first plant, γ in the second plant; (MC in the second plant will equal MC in the first plant at this point). Further expansion of output should be allocated between the two plants so as to keep MC equal in the two plants; this will necessitate further *reductions* in output in the first plant if MC in the second plant is not at its minimum at output γ. This procedure must be repeated with successive plants whenever the MC in producing plants would rise above the minimum AVC in a non-producing plant, until the output is reached for which P= MC in the producing plants. If the aggregate AVC function is continuous, price and output are given directly by the intersection of D and MC. If there is more than one such intersection we are forced to a consumer surplus type of analysis; we shall not pursue this line of development. This problem can of course be treated algebraically if the cost functions can be determined, e.g. given n plants with total cost function

$$T_j = A_j + B_j X_j - C_j X^2_j + D_j X^3_j;\ j = 1, \cdots n$$

and the condition $\sum_{j=1}^{n} X_j = \alpha;\ x_j \geqslant 0$

one can readily solve for the X_j and establish conditions under which X_j is positive, etc.

useful in perfectly general terms and the above-discussed forms appear to be the most relevant, at least for the steel industry.

It is important at this point to distinguish between marginal private cost, which will almost certainly include large wage costs, and marginal social cost, for which these labour costs may be far less. If there is considerable unemployment in this industry which cannot (or rather should not) be solved by transfer to other industries in view of the temporary nature of the decline in demand, social wage costs will be almost zero and may even be negative (i.e., if the alternative, unemployment, has a positive cost in the form of psychic or moral losses). A price policy based on marginal social costs may result in very large financial losses (which is the very reason why such a policy is utterly impractical when prices are determined by private enterprise). If these have to be met out of taxes, as they would if depression in this one industry were accompanied by booming activity in the remainder of the economy, a distribution question would present itself.

Where the demand for the product is highly inelastic so that production is virtually identical, whether price is maintained at the former level or is lowered in accordance with the marginal cost principle, the decision can rest primarily on the distributive issue. Where demand is more elastic, the gain from the allocative point of view will have to be weighed against any distributive loss.[4]

Where the economy generally is suffering from inadequate demand, the losses present no problem. They provide an automatic method by which government can inject purchasing power while maintaining the allocative function of the price system at maximum efficiency.

The Problem of Measurement

The practical problems of determining standard costs in a multi-product plant are well known, but the continued development of high-grade standard costing procedures in industry should serve to provide reasonably accurate data. Since these are required in any case for

[4] We have been assuming that the industry is nationally owned. If it is not, even more serious distributive and financial problems arise. According to W. A. Lewis, the proposition that, 'in industries where average cost falls as output extends, the industry should charge less than average cost and receive a subsidy . . . is quite fallacious' ('The Price Policy of Public Corporations' in *Problems of Nationalized Industry*, ed. W. A. Robson, New York, 1952, p. 187). But Professor Lewis fails to recognize that, except in the special case of completely inelastic demand, his proposal that 'no consumer should be excluded who is willing to pay the marginal cost of use; but between them, the consumers of this commodity, as a group, must pay the rest of society for labour and materials supplied by the rest of society to set up the establishment' (p. 188) will be impossible to achieve without uneconomic restriction of output. This point is treated at some length in an earlier paper, D. G. Tyndall, 'The Relative Merits of Average Cost Pricing, Marginal Cost Pricing and Price Discrimination', *Quarterly Journal of Economics*, LXV (August 1951), pp. 346-52.

efficient internal control, they should be available for pricing. Unfortunately, the same cannot be said for the average variable cost and marginal cost data which would be required to implement the policy outlined in the last few paragraphs. Even if we were satisfied with marginal private cost, we would face immense problems; the measurement of marginal social cost is even more difficult, since the divergence between social and private cost may be quite different in the several plant locations.

Under certain technological conditions (e.g., those which approximate those in our figures I and II — the steel industry might be reasonably close) reasonable approximations for the major products should be obtainable. One must recognize that in general one cannot hope to attain any high degree of accuracy, but it seems unlikely that one could not improve over the only alternative, namely, mere maintenance of the former price.

We have been assuming that price is approximately equal to marginal cost in all other industries in the economy. If this is not so, we are faced with a dilemma for which no general solution has yet been found. Even if the ratio of price to marginal cost were equal in each of the other industries, we would have to choose between the malallocation of the resources among their various uses other than leisure, and malallocation as between leisure and all other uses. One might attempt, by a well-rounded program of governmental regulation of various types, to make reality conform as closely as possible to the assumed state.

Alternatively one might accept, as the lesser of evils, rigidity of pricing of certain products, and adapt pricing in the administered area to this condition so as to minimize the social loss.

Consider, for example, a situation where steel (nationally administered) competes with lumber (competitively priced, $P = MC$) and with aluminum (oligopolistically priced, $P > MC$ when demand is below 'capacity' output). If the price of steel is set so as to equal marginal cost, steel will be substituted for aluminum even though the net social benefit would be greater if aluminum were used. If they were close substitutes in their more important uses, the aluminum industry would be forced to accept tremendous losses. If, alternatively, the price of steel were maintained so as to retain its former relationship to the aluminum price, wood would replace it where this was unwarranted from the social point of view, *and*, in uses where wood was not a close substitute, production would be restricted unnecessarily.

It would obviously be very difficult to obtain accurate measures of the social loss arising from these two alternatives and from other

'intermediate' solutions, but without some measure of such losses no rational choice among the alternatives is possible.

Comparison with Stones's and Shone's Conclusions

The foregoing analysis is applicable when either all producing *or* all consuming units are located at the same point. Messrs. Stones and Shone seem, implicitly, to have limited their discussion to this case, and before adding a word on the more general case, we shall compare our conclusions with theirs.

Stones argues that the price of each product should be based on an average of the standard costs of the more efficient firms.[8] He would include in price a margin of profit over cost which would provide for 'the service of issued and loan capital' plus something — how much is left distressingly vague — for development. We see no reason why any 'provision for development' should be included in price. Our marginal cost solution will provide a 'normal' rate of return on *newly* invested capital if new investment is actually taking place at the ideal rate or if the industry should happen to attain long-run static equilibrium. This, plus any excess profits or losses due to under- or over-expansion, changes in the general price level, etc., would be at the disposal of the Treasury. The 'modern fashion' of ploughing-back profits should be disregarded. Funds for expansion should be raised directly from the capital market or indirectly through Treasury operations. If the plants need funds for new investment, it might seem simpler to leave their profits with them, but this may tend to build up the feeling that the firm has a 'right' to use them as they see fit. We shall not consider the difficult question of the use of 'profits' to provide incentive payments to 'labour' and/or management.

It may be argued that a 'normal rate of return' is also distressingly vague. There are, of course, very real difficulties in actually determining the 'normal rate' but the concept itself is clear. The 'normal rate' is the sum of the pure rate of interest plus a factor to cover the uninsurable risks of loss of capital. Where there exist private industries of comparable risk, the rate of return (i.e. profit) necessary to attract capital to those industries will normally provide a satisfactory measure.

The problem of the replacement of fixed assets in circumstances where replacement costs have risen far above historical cost, which Stones raises, should be viewed as a financing problem *not* a pricing

[8] Op. cit., p. 36. His only reason is to avoid protecting inefficient firms. Stones seems to identify 'efficiency' with 'low cost', but, as was pointed out above, a high cost plant may be as efficient as management and organization planning can make it, the high costs being due to the character of its raw material supply. In such circumstances, efficiency in resource use may require that price be based on the cost of this high cost plant.

problem. Except where excess capacity exists, marginal cost pricing will require the inclusion in cost of depreciation based on replacement cost. (On this point we are in full agreement with Shone.) If the firm's replacement schedule is spread evenly through time, the depreciation reserves accrued each year will exactly equal the amount required for replacement.[6] If the firm's replacement schedule is not even and it has used the reserves to accumulate cash or its equivalent, it will suffer from inflation in the same way as any other holder of cash and, in the absence of positive corporate saving, will be unable to maintain its real assets at their former level — in other words, it will have to plough back profits or obtain outside capital to enable it to replace its assets. The financial problems of asset replacement provide no justification for increasing *price* beyond marginal cost. Whether the required funds should be obtained by permitting the industry to retain its profits, by drawing on the Treasury, by permitting the industry to sell bonds on the capital market, or by some combination of the above and/or other devices,[7] is a financing problem.

Mr. Shone[8] suggests three alternative cost bases for price determination:

1. The cost of the highest cost producer. This, he believes 'theoretically to be closest to the principle enunciated in modern marginal analysis under which the price would be just sufficient to meet prime costs of the marginal producer (or of the marginal output of all producers)' (p. 51).
2. The average cost of all producers.
3. The cost of the 'most efficient' producer, i.e. 'in the case of an expanding industry at the price at which new plant can operate and secure a reasonable return on current capital costs'.

[6] A simple example will demonstrate the point:
Assume a plant with assets consisting of ten machines, each with ten-year original life and original cost of $100, with remaining life at time, t_0, from 1 to 10 years. Depreciation of $100 will be accrued each year, equal to replacement cost. At time t_0, replacement cost increases 10 per cent. Then depreciation charges should be raised by 10 per cent. Depreciation accrued for the ensuing year will be $110, equal to replacement cost.
At time t_1, replacement cost increases by a further 10 per cent. Depreciation charges will again be raised 10 per cent and the amount accrued for the ensuing year will be $121, again equal to replacement cost.
And so on indefinitely.

[7] For example, it may be decided that, all things considered, it is best to raise the required funds by a tax on steel users, and that this could most easily be collected by increasing the price of steel products. It might be difficult to justify such a tax from the point of view of equity, but the same can be said of many other taxes.

[8] Op. cit., p. 51.

Mr. Shone does not analyze these alternatives nor even state his preference.. It will be noted that our marginal cost solution contains both his first and his third alternative as special cases. The third is completely consistent with modern marginal analysis so long as the capacity of the industry keeps pace with demand. Where the industry's capacity is out of step with demand, resort to explicit marginalism is necessary, and price should be set at marginal cost. If the usual assumption of linear total cost function is valid in the relevant range, this will mean that price should equal the average variable cost of the highest cost producer (among those who are actually producing). See our figure IIB above.

Where transportation costs of raw materials or finished products are not insignificant, the 'simple' solutions set forth above must be replaced by more complex ones.

Activity Analysis[9] is able to provide solutions to these problems but we shall not attempt to develop these in the present paper.

[9] See e.g. George B. Dantzig, 'Application of the Simplex Method to a Transportation Problem', in *Activity Analysis of Production and Location*, ed. T. C. Koopmans (N.Y., 1951), chap. XXIII.

UNIVERSITY OF CALIFORNIA, BERKELEY

DIRECT AND INDIRECT EXPORTS

by J. A. P. Treasure

The publication of Volume III of the Census of Distribution 1950, which deals with the 'Wholesale Trades', when taken in conjunction with the Census of Production for 1950, enables us for the first time to assess in statistical terms the relative importance of merchants and manufacturers in Britain's export trade.

Two statements have tended to be made on this topic in the past, namely: *first*, that 'export houses' as distinct from manufacturers, account for between two-thirds and three-quarters of total U.K. exports; and *second*, that the importance of merchants in the export trade is declining. This latter statement was made as long ago as 1929 by the Balfour Committee on Industry and Trade and it has been repeated many times since. The origin of the former statement is a little obscure but it seems to have been based on some pre-war estimates of the amount of shipping space booked by merchant houses.

The new information provided by the two Census Reports does not, of course, enable us to come to any conclusions about trends; they can only be made if and when the results of the next Census of Distribution covering the Wholesale Trades become available (the Verdon-Smith Committee Report made no explicit recommendation when this should be undertaken). It is now possible, however, by using the Census data to obtain a fairly clear picture of the organization of Britain's export trade at least for the year 1950.

The main conclusion which may be drawn on the basis of the data provided by the Censuses of Distribution and Production is that the export sales of merchants and agents in this country accounted for 40-45 per cent of total British exports (including re-exports) in 1950; and that the share taken by manufacturers of the total was, consequently, 55-60 per cent.

It may be interesting to compare these proportions with similar ones for the home market. Table 9 of the Census of the Wholesale Trades tells us that sales by wholesalers to retailers amounted to £3034 millions[1] (excluding Purchase Tax) in 1950; and Table 24 of Volume II of the Census of Distribution tells us that total purchases by retailers, from wholesalers and manufacturers combined,

[1] It should be realized that not all wholesalers or retailers completed Census forms. The effect of this 'non-response' is assumed to cancel out as between retailer purchases and wholesaler sales.

amounted to about £4350 millions.[2] Thus, it appears that retailers purchased about 70 per cent of their goods from wholesalers and about 30 per cent of their goods direct from manufacturers.[3]

It would be tedious to give a detailed description step by step of the way in which the Census data were analysed so as to arrive at the shares of British exports accounted for by merchants and manufacturers. However, broadly speaking, the method used was as follows: the Census of Production provided data about exports by manufacturers and the Census of Distribution provided data about exports by merchants and agents. These two sets of data when put together were then compared with the data about total U.K. exports provided by the Trade and Navigation Accounts. A number of technical problems had to be solved in doing this. For example, the Census of Production 1950 did not cover the activities of firms employing less than 10 persons; thus some estimate had to be made of the exports of these small firms. Again, some allowance had to be made for the fact that Northern Ireland is included within the scope of the Trade and Navigation Accounts but excluded from the scope of the two Censuses. There were a number of other technical problems: differences in time-periods, non-disclosure of confidential information, the valuation of exports and production — and so forth. It is pleasant to be able to report that, when reasonable allowances have been made for all these and other factors, there is a satisfactory degree of correspondence between the various sets of data.

It is important, nevertheless, to be fully aware of the fact that this satisfactory degree of correspondence though striking does not necessarily prove that the conclusion reached above is 'correct'; it means, rather, that within the context of the definitions adopted by the two Censuses, information has been provided and analysed in a consistent way. Statistical consistency, however desirable, proves nothing about the economic significance of the statement that mer-

[2] Table 24 gives a figure of £4585 millions for purchases by retailers from wholesalers and manufacturers combined. However, this figure includes purchase tax on the goods purchased by retailers. The total yield of purchase tax in 1950 was approximately £300 millions. It seems likely that the greater part of this sum would have been levied on goods bought by retailers; in the absence of detailed figures on this point, it is assumed that £250 millions of the total purchase tax yield was so levied.

[3] Table 3 of the Census of Production 1950 provides data about sales and transfers by manufacturers to retailers. There is a satisfactory degree of correspondence between the share of total retailer purchases accounted for by manufacturers which may be computed using this data with the share arrived at above on the basis of Census of Distribution data. Though there is no reason to suppose that the proportions given in the text would be significantly affected, it should be realized that in a number of firms the functions of retailing and/or wholesaling and/or manufacturing are combined with the result that where allowance cannot be made for this combination, figures purporting to refer, for example, to wholesaler sales will contain some sales of manufactured goods and vice versa. Allowance also must be made in this calculation for purchases by retailers from (*a*) agriculture (*b*) households and (*c*) overseas.

chants account for 40-45 per cent of British exports; this clearly depends on what is meant by the term 'merchant' in this context. From an economic point of view, much of the interest in the role of the export merchant derives from the assumption normally made that a 'merchant' exercises little or no control over the production of the goods that he sells. Thus, the implication of the conclusion reached above would be, on this basis, that in the case of 40-45 per cent of British exports there is no direct link between the export decision and the production decision — with all that that entails in advertising, product design, and general sales promotion.

It would be wrong, however, to interpret the conclusion reached above in this way. Statisticians are forced to draw distinctions of a somewhat arbitrary kind in analysing data. The complexity of the real world is such, however, that these distinctions, though necessary, can be misleading. For example, to the Census of Distribution a merchant is an organization the main business of which is merchanting. Yet in many cases merchants are also manufacturers and manufacturers are also merchants; in some trades (called by the Census the 'overlap' trades) this combination of functions is the norm, e.g. tea blending. In the case of the 'overlap' trades, special arrangements were made whereby establishments engaging in both activities were allocated to the Census of Distribution with the exception of establishments in the textile converting trade, all of which were allocated to the Census of Production. But in other trades where the phenomenon was less prominent, special arrangements were not made. Thus, the full effect of this complication cannot be evaluated quantitatively, but it must be borne in mind when drawing conclusions about the relative importance of merchants and manufacturers in the export trade. A full appreciation of any divergence between actual trade organization and Census definitions might, of course, be obtained by a detailed analysis of the role of merchants and manufacturers in the export trade of each of the main commodity groups.

Then, again, a considerable part, perhaps one-third, of the total of 'indirect' exports, which amounted to about £1000 millions in 1950, was accounted for by exports made through 'invoicing' and 'non-invoicing' agents, i.e. confirming houses, purchasing branches of overseas firms etc. In some cases, the participation of agents of this type in the export transaction does not inhibit the British manufacturer from making contacts with overseas buyers or from actively developing his overseas trade.

Finally, it should be pointed out that in certain trades merchants, though on the one hand fully controlling the export transaction and on the other refraining from engaging in actual production in any

form, may nevertheless exercise considerable control over production decisions perhaps because of the size of their orders relative to the total output of their suppliers. Thus, for this reason, and for the reason advanced in the previous paragraph, the 55-60 per cent share allocated to manufacturers might well underestimate the extent to which there are direct links between export decisions and production decisions in the British export trade.

However, despite these qualifications and difficulties, it seems fair to conclude that the share of the merchant in British export trade is smaller than has previously been thought. On the other hand, as has already been pointed out, exports made by merchants and agents in 1950 amounted to about £1000 millions so that absolutely their role is still one of great importance.

LONDON

LABOUR PRODUCTIVITY AND UTILIZATION IN CAPITALIST AND CO-OPERATIVE SHOP TRADING

by C. Roberts

The publication of the Census of Distribution means that substantial information concerning the retail trade can now take the place of more or less intelligent guess work. The accompanying table, summarizing some of this data, shows some rather surprising results of comparing the productivity and utilization of labour in capitalist and co-operative shops for selected commodity groups, by size of organization.

Two complementary criteria are employed.

(*a*) Cash sales per employee per annum, which is taken as measuring productivity.

(*b*) Wages (including salaries) cost per £ of sales, which indicates the utilization of labour, in terms of cost.

The actual cost of labour assumes some importance for two reasons. Firstly the negotiated wage rates for co-operative distributive employees were approximately 5 per cent higher than those for capitalist employees; secondly, the make-up of co-operative selling personnel was different; the co-operatives employing approximately 16 per cent more men and proportionately fewer women than the average for the retail trades.

The data available for all retail trade (excluding co-operatives) includes many organizations with working proprietors and unpaid helpers, where the second, 'b', criterion cannot be applied; the cash sales per employee are, however, shown. In the light of this, it may be thought that a better comparison would be with organizations without working proprietors.

Contrary to what was expected, the table shows that cash sales per employee in co-operative societies were substantially higher, in each of the four commodity groups, and for all sizes of organization, than for organizations without working proprietors. It is also higher than for all non-co-operative organizations, except for the large-scale retailing of clothing, and the retailing of furniture by organizations having 25-49 establishments, where the non-co-operative sales per employee are extraordinarily high.

Despite the payment of higher wages and the employment of more expensive types of personnel, the wages cost per £ of sales is lower in co-operatives than for organizations without working

TABLE SHOWING (*a*) SALES PER EMPLOYEE PER ANNUM AND (*b*) WAGES COST PER £ OF SALES IN CAPITALIST AND CO-OPERATIVE ENTERPRISE.*

Commodity Groups		*Establishments per Organization*					
		1	2-9	10-24	25-49	50-99	*Over* 100
GROCERY							
All organizations other than Co-ops.	*a*	£2,331	£2,716	£3,004	£2,970	£2,603	£2,954
Of which, organizations without working proprietors and unpaid helpers	*a*	£2,263	£2,754		£2,457		£2,584
	b	20.9d.	22.8d.		26.0d.		24.1d.
Co-operatives	*a*	£3,130		£3,660	£3,516	£3,523	£3,462
	b	26.1d.		21.8d.	22.8d.	22.8d.	23.1d.
CLOTHING							
All organizations other than Co-ops.	*a*	£1,948	£2,587	£3,479	£4,014	£3,369	£3,545
Of which organizations without working proprietors and unpaid helpers	*a*	£1,292	£2,494	£2,547		£3,114	
	b	36.2d.	29.3d.	27.3d.		22.8d.	
Co-operatives	*a*	£3,965		£3,934	£3,319	£3,332	£3,249
	b	20.2d.		20.4d.	24.2d.	24.1d.	24.8d.
FURNITURE							
All Organizations other than Co-ops.	*a*	£2,471	£3,305	£4,314	£6,616	£4,200	
Of which, organizations without working proprietors and unpaid helpers	*a*	£1,748	£3,099	£3,660[1]			
	b	40.8d.	27.8d.	23.5d.[1]			
Co-operatives	*a*	£4,044		£5,375	£4,757	£4,932	£4,850
	b	19.4d.		15.0d.	16.9d.	16.1d.	16.6d.
DOMESTIC HARDWARE							
All Organizations other than Co-ops.	*a*	£1,838	£2,209	£2,472	£2,236	£2,479	£2,605
Of which, organiztions without working proprietors and unpaid helpers	*a*	£1,576	£2,406[2]				
	b	36.9d.	34.0d.[2]				
Co-operatives	*a*	£4,276		£3,957	£3,963	£3,200	£4,542
	b	18.7d.		20.2d.	20.2d.	25.0d.	17.63d.

Source: Census of Distribution, 1950.

* Sales per employee per annum shown along the lines marked 'a' in £'s.
Wages cost per £ of sales shown along lines marked 'b', in pence.
Each part-time employee taken to be equivalent to one half a full-time employee.

[1] Figures for all organizations with more than 10 establishments.

[2] Figures for all organizations having more than one establishment.

proprietors, except for the small-scale distribution of groceries, and the large-scale retailing of clothing.

Explanation of these facts, disclosed by the Census, will require further investigation. One possible factor is the peculiar commercial philosophy which is inherent in co-operative trading. The economists' assumption of profit maximization is not appropriate when considering co-operative trading problems. Consciousness of the rate of dividend leads to greater concern with the margin per £ of sales, than with total profit. This, in turn, may lead to considerable conservatism in the promotion of trade, unless there is relative certainty that existing margins will be earned on the additional sales. It is suggested that co-operative societies may be prone to rely on the continued regularity of their existing trade which, in turn, will depend to a large extent on the rate of dividend. Falling in line with this policy is the avoidance of intense shopping peaks by Saturday afternoon closing, a widespread co-operative custom. As a result of the dividend attraction, members may be encouraged to shop at other times. Thus, on the basis of a relatively regular trade and the avoidance of intense shopping peaks, the co-operatives may be in a position to secure a more precise balance between volume of sales, and personnel engaged.

A further outcome of dividend trading is the anxiousness of the co-operatives to sell at the minimum cost per £ of sales. This possibly leads to the employment of an absolute minimum selling staff, and to reliance on the dividend to more than compensate their membership for any inconvenience arising out of this.

In the light of such considerations, the general nature of the differences shown in the table, must be explained against the background of the fundamentally different commercial approaches of the two institutional systems of distribution. Whether one can say that one is more 'efficient' in terms of labour productivity and utilization than the other would seem to depend, largely, upon what particular set of welfare value judgements govern the assessment.

FACULTY OF COMMERCE AND SOCIAL SCIENCE,
UNIVERSITY OF BIRMINGHAM

THE REPORT OF THE ATTORNEY GENERAL'S NATIONAL COMMITTEE TO STUDY THE ANTITRUST LAWS[1]

by WARD S. BOWMAN, JR.

THE National Committee to Study the Antitrust Laws was appointed in 1953. It comprised some sixty members, principally practising lawyers with experience in antitrust cases, but also including law professors teaching in the trade regulation field, and economists whose fields of interest embraced problems of market organization, business behavior, or monopoly theory. Representatives of interested government agencies were also included. Co-chairman of the Committee, appointed by Attorney General Herbert Brownell, Jr., were Stanley N. Barnes, Assistant Attorney General in charge of the Antitrust Division, and S. Chesterfield Oppenheim, Professor of Law at the University of Michigan Law School.

The task assigned to the Committee involved a comprehensive study of the antitrust laws of the United States to, in the words of President Eisenhower, 'prepare the way for modernizing and strengthening our laws to preserve American free enterprise against monopoly and unfair competition'.[2]

The enormity of the task undertaken called for careful organization and division of responsibility. The field was divided into eight major parts: (1) Sections 1 and 2 of the Sherman Act Generally: A Policy Against 'Undue Limitation on Competitive Conditions', (2) Trade and Commerce with Foreign Nations, (3) Mergers, (4) Antitrust Policy on Distribution, (5) Patent Antitrust Problems, (6) Exemptions from Antitrust Coverage, (7) Economic Indicia of Competition and Monopoly, and (8) Antitrust Administration and Enforcement. Each of these sections of the *Report* not only summarizes existing law on the subject, but indicates how the law developed and the apparent direction of its movement. In addition, the *Report* indicates varying degrees of approval or disapproval of existing policy as interpreted by the courts and the administrative agencies.

The Committee purposely avoided legislative recommendations. Throughout its deliberation it claimed to be guided by the belief

[1] U. S. Government Printing Office (March 31st, 1955), $1.00.
[2] *Report*, p. iv.

that 'legislative revision should not be proposed whenever prevailing precedents of interpretation and administrative policy permitted effectuation of the Committee's proposals for resolving inconsistencies and defects short of legislative action'.[3]

The division of the subject matter into the eight classifications provides a well devised pattern for study involving a minimum of overlapping. Moreover, the factual parts, outlining the major cases in the development of the law pertaining to the problems presented in the various sections, are well summarized. General readers who are looking for a good summary of the law on particular antitrust problems will find the *Report* useful and readable. For this purpose the *Report* is far superior to 'hornbook' references.

Those who expect to find incisive analysis of the pros and cons of the basic issues of antitrust policy are likely to be disappointed, however. With so broad a field of inquiry it is perhaps not surprising that intensive and thorough analysis of particular problems is not presented. Conclusions in the *Report* are phrased so as to maximize agreement and to minimize controversy. This has hidden from the reader both the strengths and the weaknesses of the analyses upon which the conclusions are based. A decision to relegate economic discussion to a separate chapter has aggravated this difficulty. Consequently, economic analysis is not focused on particular problems or related to the conclusions reached on specific issues, but rather is confined to general concepts. This not only detracts from the value of the conclusions in the early sections of the *Report*, but also makes the economic discussion unnecessarily barren for the general reader.

In reviewing the eight sections into which the *Report* has been divided one gets the impression that the conclusions represent opinion polls on selected antitrust issues. Although the conclusions probably quite accurately reflect the opinion of the majority of the antitrust bar of this country, the failure to disclose a convincing analytical justification for conclusions reached makes the position of the dissenters less demanding in terms of analysis. Stating this differently, it seems unlikely that the Attorney General's *Report* will provide a means for dispelling continued controversy on any of the major issues of policy with which it deals. Undoubtedly it will provide suitable quotations for innumerable orations on the subject.

Analysis of the Committee's principal explorations in the following sections parallels the chapter divisions of the *Report*.

[3] S. Chesterfield Oppenheim, 'Highlights of the Final Report of the Attorney General's National Committee to Study the Antitrust Laws', 1 *Antitrust Bulletin* 34 (April 1955).

I. A POLICY AGAINST 'UNDUE[4] LIMITATIONS ON COMPETITIVE CONDITIONS' — SECTIONS 1 AND 2 OF THE SHERMAN ACT GENERALLY

The basic antitrust law in the United States, the Sherman Act, passed in 1890, contains two short substantive sections. Section 1 provides:

> Every contract, combination in the form of trust or otherwise, or conspiracy, in restraint of trade or commerce among the several states, or with foreign nations, is hereby declared to be illegal . . . Every person who shall make any contract or engage in any combination or conspiracy hereby declared to be illegal shall be guilty of a misdemeanor. . . .

Section 2 provides:

> Every person who shall monopolize, or attempt to monopolize, or combine or conspire with any other person or persons, to monopolize any part of the trade or commerce among the several states, or with foreign nations, shall be guilty of a misdemeanor.

The Committee stresses the need for a rule which permits the courts to decide whether conduct is significantly and unreasonably anticompetitive in character or effect. This is the so-called 'Rule of Reason' approach.[5] This does not, according to the Committee's interpretation, preclude the existence of conduct which can conclusively be presumed to be illegal. Such joint activity among competitors as fixing prices, allocating sales territory or boycotting are *per se* offenses — i.e., presumed to be unreasonable. This means that the recommendation of the 'Rule of Reason' is an admonition not automatically to judge illegal conduct which is not unequivocally anti-competitive.

Most business conduct which is alleged to involve trade restraint raises hard questions involving careful analysis. The *Report* recognizes the need for economic study, and admonishes that the Act 'must

[4] The use of the term 'undue' or 'unreasonable', although neither appears in the Sherman Act, has been the subject of heated and protracted controversy ever since the opinion in the Supreme Court by Chief Justice White in the Standard Oil case in 1911. [*Standard Oil Co. of N.J.* v. *United States*, 221 U.S. 1 (1911).]

In summarizing the common law regarding restraints of trade which the Sherman Act embodied, Chief Justice White said that the common law was dominated by the 'dread of enhancement of prices and other wrongs which it was thought would flow from the *undue* limitations on competitive conditions' [emphasis added]. This fear, he said, 'led, as a matter of public policy, to the prohibition or treating as illegal all contracts or acts which were *unreasonably* restrictive of competitive conditions. Such conclusion, according to the Court, might stem either from the nature or character of the contract or act, or from 'surrounding circumstances' which gave 'rise to the inference or presumption' that they 'tended to bring about evils, such as enhancement of prices, which were considered to be against public policy'.

[5] See note 4 *supra*.

be adaptable to dynamic competitive process', but there is not direction concerning precisely what analysis would be relevant to reach a particular result. For example, determining that price fixing exists is a difficult problem. The *United States v. Socony-Vacuum Oil Co., Inc.* case[6] is cited in the *Report* for the proposition that market analysis is often required to determine the purpose and effect of challenged conduct. Here defendants had participated in programs for buying 'surplus' gasoline from small independent refiners as a part of a plan to maintain a floor under the market. The *Report* points out that the major gasoline companies in combination probably did not have the power to control the market as monopolists, but nonetheless were held to have exercised the power to influence materially market prices by buying significant amounts of gasoline in the spot market which at most included less than 5 percent of the Mid-Continent gasoline sales.[7] The conduct was found to be illegal.

If, as the *Report* indicates, this case can be said to stand for the proposition that defendants' activities are to be viewed against the 'dynamics of price formation', or that 'market analysis is needed to determine the purpose and effect of the challenged conduct' it would be useful to know something about what 'dynamic market factors' might have been or should have been crucial in forming the Socony decision to go the other way. Subsequently the *Report* (p. 23) discusses *Appalachian Coals, Inc. v. United States*,[8] decided in the depression year 1933. Here, in advance of actual operations, a plan was upheld which united almost 75 per cent of the commercial production of bituminous coal in the Appalachian district into a single regional sales agency. The *Report* cites this case (without approval or disapproval) for the proposition that there is need for a showing that such a plan contemplated or necessarily involved control over market prices, suggesting that it is relevant that coal is 'a large competitive' industry, that entry is 'easy and uncontrolled', and, that a small group may 'end "injurious (competitive) practices" — to improve the group's competitive position' if it cannot dominate prices. Here again the *Report* gives no clue as to what might or should be required to force this case to be decided differently. Nor does the *Report* attempt to distinguish the *Appalachian* case from prior or subsequent cases in terms of either legal or economic criteria. Consequently the impression is left that the *Socony* and *Appalachian* cases are not inconsistent and that one may be relied upon equally as much as the other. It would have been both interesting and useful

[6] 310 U.S. 150 (1940).
[7] *Report*, p. 16.
[8] 288 U.S. 344 (1933).

to have had the benefit of the analysis of the economists on the Committee concerning the compatibility of these two decisions with a rule against price fixing.

Equally difficult problems are raised by the Committee in its discussion of exclusive dealerships. The Committee recommends that they be held illegal when they can be shown to be a part of an attempt to monopolize, when their effect is unreasonable, when their use is not ancillary to a legal purpose, or when they unreasonably close competition from the dealers' market. Only very general criteria for determining 'reasonableness' or 'unreasonableness' are offered. Factors listed include proportion of business controlled (how much?), strength of remaining competitors (are a few large companies better or worse than many small ones?), and whether a purpose to monopolize is involved (how could one use exclusive dealerships with the purpose or the intention to monopolize a trade?). The economic problem here is very similar analytically to that of vertical integration or resale price maintenance each of which is treated elsewhere in the *Report*. No clue is afforded as to how the Committee came to divergent conclusions on these problems. How, for example, does a maintained resale price eliminate more competition among distributors than having no competitor at all in one's area?[9]

The Committee's conclusions with respect to Section 1 of the Sherman Act do little more than paraphrase existing law on the subject. Price fixing agreements are *per se* offenses. Simple market division agreements should be treated as price fixing agreements. Exclusive territory arrangements are permissible if not jointly agreed upon, if not part of a plan to monopolize or if the effect is not unreasonably to foreclose competition from the dealers' market. Concerted action solely between parent and subsidiary should not be illegal unless there is a purpose or effect coercively to restrain outsiders. Parallel business behavior, without more, should not constitute a Sherman Act offense. These Committee conclusions regarding intercorporate conspiracy and parallel action do suggest that the Committee believes there is a danger of finding violations of Section 1 when none should exist.

Section 2 of the Sherman Act prohibits monopolizing or attempting to monopolize either by single firms or firms in combination. The *Report* stresses its view that mere power to affect price or to exclude competitors is not sufficient to prove the offense of monopolization. There must be purpose or intent to exercise the power. This intent, however, is distinguishable from a specific intent. It may be inferred

[9] See 'Recommendations on Resale Price Maintenance', Section IV *infra*.

from the manner the power was acquired, maintained or used. If, for example, the power was achieved or acquired by conduct violative of Section 1, a Section 2 violation would result, but Section 2 can also be violated by deliberative action not violative of Section 1. The *Report*, therefore, emphasizes the importance of inquiry into the history and to the business policy of the monopoly.

The appropriate market in which monopoly power is to be measured, according to the *Report*, is the 'area of effective competition within which defendants operate'. Involved are the range of products and services covered as well as geographical limits. Courts have pointed out that Section 2 of the Act makes it unlawful to monopolize 'any part' of interstate commerce, without specifying how large a part must be affected. But most important is a determination of the existence of power. Judicial searches for power start with relative size, which is recognized as an earmark of monopoly power. The *Report*, after reviewing a number of landmark monopoly cases, comes to the conclusion that: 'Measuring monopoly power depends upon a full evaluation of the market and its functioning to determine whether on balance the defendants' power over the interrelated elements of supply, price and entry are sufficiently great to be classed as monopoly power.'

According to the *Report* the decisions illuminate the economic theory of the courts in evaluating these facts.[10] If so, the *Report* has turned off the lights. Other than an admonition to study carefully, guides for finding the existence of monopoly power, either in terms of structure or behaviour, are not provided by the Committee.

II. TRADE OR COMMERCE WITH FOREIGN NATIONS

Blanket exemption of foreign commerce from the antitrust laws is rejected by the Committee. In fact, the *Report* proposes approval of identical standards with respect to foreign and domestic cases. It then approves an important caveat (from the dissenting opinion in the Timken case[11]):

> the circumstances of foreign trade may alter the incidence of what in the setting of domestic commerce would be a clear case of unreasonable restraint.

The need for exemptions from the antitrust laws for cases involving purchase of critical and strategic materials from abroad is emphasized. Antitrust is said to be only one of several interrelated

[10] *Report*, p. 54.
[11] *Timken Co.* v. *United States*, 341 U.S. 593, 605-6 (1951).

government policies, and the *Report* stresses the difficulties American firms may have in meeting double standards of American and foreign laws. How these difficulties specifically might be overcome, either under United States law or by cooperation with foreign powers, is not discussed. The *Report* also recommends that the Webb-Pomerene Act be retained, pointing to the restrictive patterns of trade permitted in other parts of the world.

III. MERGERS

According to the *Report* mergers should be prohibited if there is *reasonable probability* of substantial lessening of competition or tendency to create a monopoly. But an *incipiency* rule which is involved here under Section 7 of the Clayton Act means changing patterns of proof and case-by-case study according to the *Report*. Any appreciable movement toward monopoly power by merger, it is said, should be condemned, even though involving only minor acquisitions. Readers are not informed by the *Report* as to why the standard of Section 7 *should* be more strict than that of Section 2 of the Sherman Act. It satisfies the Committee that this seems to have been the intent of Congress at the time of passage of the Clayton Act in 1914 and at the time of its recent Amendment in 1950.

The method of procedure recommended under Section 7 of the Clayton Act (indicated by approval of the Pillsbury Mills case[18]) is case-by-case study. There is no illumination on how a relevant case-by-case study could or should be made.

The merger problem in the United States is one of great current interest. Pending mergers in the steel and hotel industries involve important and highly controversial problems of public policy in this field. Neither the administrative agencies nor the courts are likely to find the *Report* particularly helpful in resolving these pressing issues. An example is the proposed merger between Bethlehem Steel and Youngstown Sheet and Tube. It raises basic questions of antitrust policy. Were this merger effectuated the new company would still be considerably smaller than the U.S. Steel Corporation, which produces something less than one-third of the steel in the United States. Is there more or less justification for U.S. Steel in its present size than for a newly merged company of smaller size? Will disallowing the merger set up a double standard based on historical accident? If the merger is approved what is to stop the emergence of a three firm steel industry in the United States? Could such an industry conceivably be judged to be as 'competitive' as the existing

[18] Federal Trade Commission Docket 6000 (1953).

industry? Such are the questions to which answers must be given. Guides to the answers are not in the *Report*.

IV. ANTITRUST POLICY IN DISTRIBUTION

The distributive process is the focus of the Clayton Act's specific antitrust provisions. This section of the *Report* on distribution deals principally with problems of discrimination, including price cutting, and exclusive and 'tying' arrangements which may tend toward a lessening of competition. The Clayton Act, passed in 1914, was designed to supplement the general prohibitions on monopolies and trade restraints covered by the Sherman Act. The additional legislation was designed to provide a means of stopping specific practises deemed as steps in achieving the ends proscribed by the Sherman Act. Subsequently, in the 1930s legislation was passed which the *Report* indicates was directed at mitigating the hazards of too aggressive price competition. In 1937 the Miller Tydings Amendment to the Sherman Act's Section 1 was passed exempting vertical resale price fixing agreements. A year earlier (1936) the Robinson Patman Act provided legislation designed to restrict the use of price discrimination to circumstances capable of being specifically justified by those who sold the same commodities at different prices to different customers. Both the Robinson Patman and the Miller Tydings Acts have been subjected to a great deal of criticism on the ground that they foster economic objectives inconsistent with the basic aims of the antitrust philosophy embodied in the Sherman Act.

The *Report* takes its strongest and most unequivocal stand on the resale price maintenance issue, holding that 'fair trade' relieves distributors from the rigors of price competition and is at odds with the principles of a competitive free enterprise system. Here substantive change by legislation is recommended in the form of repeal of the Miller Tydings Amendment to the Sherman Act, as well as repeal of the more recent McGuire Amendment to the Federal Trade Commission Act.[13]

The *Report* does not recommend repeal of the Robinson Patman Act, even though the discussion of its workings leaves the reader in considerable doubt as to what justifiable function it serves that is not properly served by application of the Sherman Act. The Committee takes pains to point out that determination of competitive injury should stress injury to competition as opposed to injury to competitors. Apparently a majority of the Committee believes (although

[13] The McGuire Act was passed after the Supreme Court had ruled that distributors not signing price maintenance contracts with their suppliers could not be covered by provisions of the Miller Tydings amendment allowing vertical price fixing. Under the McGuire Act non-signers could be bound.

this is not said explicitly) that predatory price discrimination is a means of driving out competitors and achieving a monopoly. The Committee, on the other hand, is not unmindful of the argument that price discrimination can be and often is a means by which more effective competition is achieved in actual markets. The Committee judiciously resolves this basic conflict by emphasizing the importance of a liberal 'meeting competition' defense to a price discrimination charge. This seems to place greater emphasis on the *purpose* or the *intention* of different prices to different customers than those who passed the Robinson Patman Act may have had in mind. Moreover, this interpretation so closely approaches the standards which elsewhere the Committee has recommended for Section 1 of the Sherman Act, that one may wonder whether the Committee might not have been motivated by a desire to avoid the political repercussions of a more forthright recommendation calling for repeal of the Robinson Patman Act.

Other problems of distribution concerning which the Committee makes recommendations include refusals to deal, exclusive dealings, and 'tying' contracts. In the absence of combination or conspiracy the *Report* finds that refusals to deal (not a part of a broader scheme or with an illegal purpose) should be safe from prosecution. Exclusive dealing, according to the Committee can either 'promote' or 'seriously clog' channels of distribution. The test under Section 3 of the Clayton Act should be — 'whether a system challenged in fact "forecloses" competitors from a substantial market' (p. 146). Why less proof should be required than under the Sherman Act test is not made apparent.

'Tying' arrangements (under which the purchase of one product is conditional on the purchase of another) are considered by the Committee to present a kind of problem distinguishable from exclusive dealing ('tying' the purchase of a product to the continued or exclusive purchase of that same product). The basis of this distinction is not clarified by the statement that tying arrangements 'serve hardly any purpose beyond suppression of competition'[14] or the statement that they permit 'wielding monopolistic leverage'.[15]

Several recommendations in the *Report* dealing with distribution do look to needed clarification of peripheral problems. Recommendations are made against very rigid provisions on brokerage allowances, buyer liability, functional discounts, criminal prohibi-

[14] Quoted from 377 U.S. at 305.
[15] Quoted from 258 U.S. at 357.
It would have been a significant contribution to monopoly theory had the Committee been able to show that a 'tie-in' does more than to maximize the monopoly return from the tying product – that is, to show the 'leverage' by which another monopoly is created.

tions, and delivered pricing. As to the latter the Committee believes that the essential problem involves whether or not collusion is involved. No suggestions are made about whether or not a delivered pricing 'system' can be used within an industry in the absence of some form of collusion. Consequently, those who are looking for clarification of the long continued controversy about the use of basing point systems will find little to help them in the Committee's *Report*.

V. PATENT-ANTITRUST PROBLEMS

The Committee's opinion is that a patentee can fix the price at which licensees may sell when the price fixed is limited to the invention covered; and in the absence of agreements with others foreclosing the availability of substitutes. Similarly, fields of use by licensees may be proscribed if limited both geographically and product-wise to the coverage of the patent. Permissible price or territorial restrictions, however, the *Report* points out, are limited to first sales and not to resales. Thus, the *Report* does not recommend that patented articles are to be an exception to its general position in opposition to resale price maintenance. The same result, however, achieved by agency arrangements, as in the General Electric case,[16] is not condemned.

From an antitrust standpoint, a tying clause in a patent license is like a tying clause in any other contract (i.e. covered by Section 3 of the Clayton Act). There has been a tendency for courts almost automatically to outlaw tying clauses on patented products because the patent, conferring a legal monopoly, makes an assumption easy that *market* power is also present. The Committee would have the courts take the additional step of evaluating the patent to make certain this is so.

One of the more difficult problems of patent policy under American antitrust law relates to the patent pool. Cross licensing of patents is desirable public policy if mutual blocking of the use of inventions is likely. On the other hand, the elimination of competition among rival patents offends the antitrust laws just as does the elimination of other forms of competition. As to this problem the Committee would make a principal test either a proof of purpose or the proof of existence of monopoly power. It is careful to point out, however, that interchange may run afoul of the law in the absence of power if licenses are not granted freely at reasonable royalties. The Committee takes a careful stand when it says: 'In any given case, a determination of legality requires an examination of the purpose of

[16] *United States* v. *General Electric Co.*, 272 U.S. 476 (1926).

the interchange, the power possessed by the interchange when formed, and its operating practise' (pp. 246-7). This rather general statement is then clarified in the following manner: 'Depending upon the situation, some of these factors, or even one of them, may be decisive. In other instances, all demand consideration' (p. 247).

The *Report* quotes with approval the language used by the Supreme Court in the *Suppiger* case[17] to the effect that where a patent is used as a means of restraining competition in the sale of an unpatented product, the successful prosecution of an infringement suit, even against one not a competitor in such a sale, is a powerful aid to the maintenance of the attempted monopoly of the unpatented article. It is thus a contributing factor in thwarting the public policy underlying the grant of the patent. 'Maintenance and enlargement of the attempted monopoly of the unpatented article are dependent to some extent upon persuading the public of the validity of the patent, which the infringement suit is intended to establish.'[18] Consequently, the *Report* concurs with the Court in the appropriateness of a misuse doctrine which declines to entertain a suit for infringement at least until the improper practise has been abandoned and the consequences of the misuse have been dissipated.

The plaintiff in a contributory infringement suit, as the *Report* points out, is necessarily seeking to enjoin conduct not technically covered by the patent. Consequently, there is the problem of applying the above mentioned misuse doctrine in a manner consistent with the patent doctrine of contributory infringement. The Committee resolves this knotty problem by referring with approval to Section 271 of the 1952 Patent Code. However, there is not unanimity of opinion in the Committee as to how much, if any, pertinent provisions of this statute cut down the breadth of prior patent abuse doctrine. This much is clear — the majority of the Committee does not believe in the elimination of the doctrine of contributory infringement.

VI. EXEMPTIONS FROM ANTITRUST COVERAGE

There is much economic activity in the United States (in addition to spheres which economists might define as 'natural monopolies' — declining cost industries) which have become exempt from the rules of competition called for by the antitrust laws. Included among the more important of these are organized labor and agricultural cooperatives. Rail, water, and air transportation are also subject to

[17] *Morton Salt* v. *G. S. Suppiger Co.*, 314 U.S. 488, 492-3 (1942).
[18] Ibid.

'special' standards of performance under government regulation. In each case the goal of public policy is often said to involve something more or something else than the competitive standard of the market place. The *Report* disclaims any purpose to judge the importance of these goals or to evaluate how they might be achieved without antitrust exemption. The *Report* in this area is limited principally to description. This is in some detail including antitrust provisions of the Transportation Act of 1920, the Federal Communications Act, the Motor Carriers Act, the Civil Aeronautics Act. Also set forth are the three principal regulatory statutes immunizing rate making agreements — the Reed-Bulwinkle Act (relating to agreements approved by the Interstate Commerce Commission regarding land transportation rates and charges); the Civil Aeronautics Act (relating to air charges); and the Maritime Commission Act (relating to carriers by water). Finally, passing references are made to the nature and extent of the organized labor and farm cooperative exemptions to the antitrust laws. The section ends with the wistful hope that statutory exemptions do not reduce antitrust prohibitions to a ghostly residuum.

VII. ECONOMIC INDICIA OF COMPETITION AND MONOPOLY

This section of the *Report* provides a sort of general treatise on the subject of competition (perfect, pure and workable). Care is taken to avoid any commitments relating to antitrust policy. According to the Co-Chairman of the Committee, 'the refinements of this technical and closely reasoned economic theory cannot be summarized without risk of doing injustice to the context as a whole'.[19] This reviewer heeds the Co-Chairman's admonition with respect to this economic appendix.

It is unfortunate that the economic talent available to the Committee did not specifically express itself on the particular substantive antitrust problems presented by the cases discussed. The impression is given that the Committee kept its economists locked in the closet. Included on the Committee were very capable students of the monopoly problem. It is to be hoped that their influence on antitrust law will not be limited to the subject matter of the section for which they were primarily responsible.

The economic section of the *Report* does, however, provide one very important function which should not be minimized. There has been a strong tendency in the United States to identify the problem of a determination of 'reasonableness' at law with a new kind of

[19] S. Chesterfield Oppenheim, 'Highlights of the Final Report of the Attorney General's National Committee to Study the Antitrust Laws', 1 *Antitrust Bulletin* 5 (April 1955).

competition called 'workable' competition, as if there were some neat set of boxes into which economists could sort the hard legal problems and get ready answers. The economic section is useful in dispelling this misconception.

VIII. ADMINISTRATION AND ENFORCEMENT

The final section of the *Report* includes a wide variety of specific recommendations. Principally these recommendations focus on alleviating or clarifying problems of defense, but they are not all of this nature. It is recommended, for example, that the maximum criminal fine per count be increased from $5000 to $10000. (Subsequently the Congress passed legislation increasing it to $50000.) A recommendation that trial proceedings should be simplified by an early particularization of issues should not necessarily disadvantage the government or private plaintiffs. The recommendation of a uniform Federal statute of limitation for private suits would dispel confusion for all parties. Also the controversial Fair Practise Conference Procedure utilized by the Federal Trade Commission is given approval for treating industry-wide problems involving advertising allowances, brokerage and price discriminations. Other recommendations suggest that the administration or relief in antitrust cases is, has been, or may be, too harsh on defendants. For example, the Committee finds it advisable to recommend that criminal cases be instituted only when the proof of violation is clear and the law is settled. It recommends that divestiture be used very sparingly and as a last resort. It recommends that the Department of Justice be authorized to issue advisory opinions. It suggests that the use of consent settlements be *not* curtailed and that the Department of Justice relax its rule that they be drafted by the defendants rather than by the Department. The *Report* also calls for a policy of substantial modification of filed consent judgments when changed circumstances permit. The Committee would also modify the severity of treble damages by vesting in the trial judge the discretion to award double or single damages.

The minority view on the Committee with respect to these recommendations is that the 'chapter of the Majority Report dealing with Administration and Enforcement offers as clear a demonstration as any that the Majority operate on the undeclared assumption that we have had too much rather than too little antitrust enforcement'.[20]

All members joining in this dissent or other dissents are not identified. Dissenting opinions are expressed specifically by Louis B. Schwartz, University of Pennsylvania Law School; Eugene V.

[20] *Report*, p. 388.

Rostow, Yale Law School; Walter Adams, Michigan State College; George Stigler, Columbia University; Alfred E. Kahn, Cornell University; J. M. Clark, Columbia University. Unfortunately, it is impossible to tell whether divergence from majority opinion is limited solely to members of the academic community.

UNIVERSITY OF
CHICAGO

A SURVEY OF MANAGEMENT EDUCATION IN THE UNITED KINGDOM

by David K. Clarke

I. INTRODUCTION

This paper is concerned primarily with the facilities available in the United Kingdom for the further education in management of those already engaged in industry and commerce. The first impression conveyed by such a study is the diversity of institutions engaged in this field and of the opportunities which they offer. The Universities, the Technical Colleges, Adult Education Centres, mainly residential and either linked to the extra-mural departments of universities or controlled by Local Education Authorities, and institutions entirely independent of public funds all play their part. In addition many organizations, including the Central Government, hospitals and large industrial and commercial undertakings, make provision for internal courses. Such variety of courses defies any attempt to produce a statistical account of the extent of management education or anything but a broad analysis and classification of the major features.

While due acknowledgment must be made of the early pioneering efforts, it remains true that the greater part of this management education in the United Kingdom began after 1945. It still bears many marks of rapid development and improvisation in post-war conditions. Certain common patterns are emerging and some future trends may be indicated. But novelty precludes any finality in judgments, although diversity is producing a rapid accumulation of experience.

With few exceptions, such as the Administrative Staff College, the institutions engaged in this field already existed for quite different purposes. Their objectives and methods are inevitably coloured by their other activities. In the Technical Colleges management studies are only a very small proportion of the total activities, which are mainly directed to the teaching of industrial and commercial skills to nationally accepted standards. British universities do not offer degrees specifically labelled 'Business Administration', but subjects of use in management, and in particular certain aspects of economics, law, psychology and accountancy, are to be found in many degree courses. In some universities teaching for scientific degrees includes some teaching in management subjects. In some modern universities the degrees in Commerce are deliberately designed as a preparation for a business career. The Adult Education Centres

usually offer a very wide variety of general courses mainly of cultural interest.

The number of organizations which to a greater or less extent provide management education for their own staff is increasing rapidly. Some of the largest concerns have now established permanent residential centres where a variety of courses for all grades of management are given. Others provide courses as the supply of students justifies it. A feature of many of these courses is to help managers to see their own tasks in the larger setting of the undertaking's history and policies and to learn to understand and co-operate with equal colleagues in other departments.

It is, however, of interest to note that many concerns which provide their own training facilities are also among those who most frequently use the facilities provided by outside institutions. It is with such institutions that most of this Paper is concerned.

The Levels of Management

The ends to which management education is directed must be related to the various levels of management characteristically found in industry and commerce. There are difficulties in defining these levels. At one extreme the foreman or first-line supervisor is readily identifiable. But at the other extreme the departmental heads and directors, commonly described as senior management, differ widely in status, calibre and length of experience as well as in their responsibilities, according to the size of the organization under their control. Between these two extremes there are what are commonly described as junior and middle management with ill-defined boundaries between them. For many men in these groups there is the additional complication that their normal experience was interrupted by the war.

Any classification must therefore be arbitrary. For the purpose of this Paper it is convenient to consider these categories of management:

(*a*) Foremen.
(*b*) Junior — Middle management holding positions below the level of departmental head or with less than ten years' experience of management.
(*c*) Middle — Senior management which will include the departmental heads of smaller companies and men with substantial experience and responsibilities in larger companies.
(*d*) Senior management covering the departmental managers and above of the medium and larger companies.

This Paper will first describe briefly the main educational provisions made for these four groups and will then discuss the major problems which arise.

II. THE PROVISION OF MANAGEMENT EDUCATION

1. *Foremen*

Most of the training of foremen takes place within the organizations to which they belong. The 'Training Within Industry' scheme promoted by the Ministry of Labour has been very widely adopted. In many Technical Colleges there are part-time courses of two years leading to an examination for a certificate in workshop management and especially that offered by the Institute of Industrial Administration. These courses cover instruction in the tasks of supervision, in labour management, production and planning, the assessment of remuneration and in costing. In addition background knowledge in economic history and instruction in written and spoken English is given. A few Technical Colleges offer full-time courses of up to three weeks. The full-time residential courses offered by about twelve institutions for Adult Education are usually for four or five days without examinations. Their emphasis is usually on aspects of human relations, on trade unions, on the place of the foreman in his organization and on work study. In some cases a background of law, economic history or current economic affairs is given. Instruction in speaking and writing is frequently given.

Group discussions, case studies and films are used in addition to the conventional lectures.

2. *Junior — Middle management*

In this group there is varied and extensive provision for the needs of specialist training, ranging from courses of evening lectures for a few weeks to part-time courses of several years' duration to acquire acknowledged professional qualifications or to full-time courses of one year at Glasgow, Manchester or London Universities for personnel management. Many of these specialist courses have some content of management subjects. But it is proposed to confine these notes to education for management in its broader aspects.

In the Technical Colleges the full-time course is the exception, although in a few notable instances it is being developed. A few Technical Colleges also have 'sandwich' courses. On the other hand, in all other institutions the courses are almost wholly full-time and usually residential. Their duration varies from a few days up to a month.

The shorter full-time courses usually cover a single aspect such as

human relations or the legal aspects of management, but the one-week IIA Summer School held at Oxford combines some study of management principles with the study of a specialist function. With an attendance of over 100, this School is larger than most of the full-time courses. The longest of the full-time courses in this category is the British Institute of Management's Executive Development Course of one month which, like most of the longer courses, combines a study of the major aspects of management with some examination of the social and economic environment. Although all these courses have some lectures, they tend to contain a larger proportion of group discussion.

The most recent development in full-time courses is the provision being made by some universities for 'Business Summer Schools' of three or four weeks. These have been held at Oxford and Cambridge and similar courses have also been held at Edinburgh and Leeds this year. A short experimental course held at Sheffield University has resulted in a novel experiment of a two-year course consisting of six fortnights of residence coinciding with the university vacations, linked by reading and occasional seminars. This course is still in its first year of operation.

These university courses are limited in their numbers, usually to about forty or less, and are confined to men nominated by their organizations as being likely to assume greater responsibilities in the future. The average age is usually about 30 or slightly more. All the university courses cover the most important of the functions of management in organization, human relations and problems of control. They also discuss problems of business policy. But they are all remarkable for the time given to the consideration of the external factors, economic, social and institutional, which bear upon business policy, and are linked with the normal teaching of the Social Sciences in the universities. Group or syndicate discussions are used at least as much as the accepted methods of academic teaching.

The greater part of the part-time teaching of management subjects at Technical Colleges is on the lines of what is known as the 'Urwick Syllabus'. There are some 3500 students in about 80 Colleges studying for examinations under this syllabus. The syllabus resulted from the report of a Committee under the chairmanship of Col. Urwick set up by the Government in 1947. It provides a three-year part-time course leading to an Intermediate Certificate, which can be followed by a two-year part-time course leading to a Diploma. These awards are obtained by examination by each College with national assessment of certain papers. The first examination for the Intermediate Certificate was held in 1950 and for the Diploma in 1953.

In 1953 some 500 certificates were awarded and 123 diplomas. The scheme is administered jointly by the British Institute of Management and the Ministry of Education.

A minimum educational requirement is made and the Technical College must be satisfied as to the ability of each student to profit from the course. The examination for the Certificate may not be taken below the age of 23 and for the Diploma below the age of 25. The Certificate is accepted as exempting students from the intermediate examinations of certain professional or specialist qualifications. The conception of the scheme owes much to the system of national certificates for particular trades which were developed from 1922 onwards to unify and raise the standard of technical education. But these certificates are designed to follow on from the formal education of the student and to accompany apprenticeship. They are therefore taken at an earlier age than the Urwick Syllabus.

The syllabus for the Intermediate Certificate requires the study of three groups of subjects: Introductory, Background and the Tools of Management. The first group includes some economic history and a preliminary survey of the nature of management. The second covers the elements of economics, law and psychology which affect management. The third includes accountancy, statistics, work measurement and incentives and office organization and methods. The syllabus for the Diploma includes two compulsory subjects: management principles and management practices, the first being concerned primarily with the analysis of the tasks of management and the second with the problems of direction and co-ordination. In addition four subjects must be chosen from a list of fourteen designed to enable the student to give his studies a bias towards his own specialism whether it is production, sales, accounting or personnel work.

Each College is free to develop its own methods of teaching and a wide variety are used with varying success. A minimum of 40 hours' attendance on each subject is required, making in all 120 hours per year for the student.

3. *Middle — Senior Management*

The only specialized institution in this field providing for those already in middle and senior management is the Administrative Staff College. It provides a residential three months' course for 60 members and runs three courses per year. Since it began in 1948 more than 1200 members have attended the College. Most members are between the ages of 32 and 43, and the average age is about 38½. Members have to be nominated by their employing organization and

are selected after interview by the College. They must have held posts of substantial responsibility and be considered as in the zone for promotion to senior positions. In selecting men and women for each session, the College pays great attention to securing a mixture of different types of organization and of different specialist experience. An important feature of the College is that it is attended by Civil Servants, local government officials and members of the Fighting Forces as well as by members from industry, finance and commerce. One-tenth of the places are made available to candidates from overseas.

The syllabus and methods of the course have been designed to use and build upon the experience of the members and to lead progressively to the consideration of problems of increasing intricacy. A short introductory subject leads to an analysis of the major internal tasks of management: the management of men, the structure of organizations and problems of delegation and control. In the next part of the course the external relations of an organization are considered: the sources of capital, relations with trade unions and with Central and Local Government. The work on all these subjects is then brought together in a series of exercises in higher policy in adapting an organization to change, and in keeping it vital and forward-looking. Parallel to these parts of the course, members undertake the study of the biographies of eminent administrators. Great attention is given to instruction in the use of figures by management. Opportunities are offered for the study of the economic background to management with special reference to international trade.

For most purposes the College is divided into six syndicates of ten members, each syndicate reflecting the mixed composition of the College. Each syndicate studies each subject under the chairmanship of one of its own members appointed by the College. Their work usually concludes in a report by each syndicate which is presented to and discussed by the College as a whole. The College regards this method as having great educational value in itself. In studying each subject the experience of members is supplemented by discussions with practical experts who visit the College, by reading and by visits to other organizations.

4. *Senior Management*

There has in recent years been a notable increase in the number of short conferences of one to three days sponsored by many different organizations. Many of these have educational value for this group and for their immediate subordinates in enlarging their experience and having to think more clearly about their own practices.

A recent development is the provision of seminars for senior managers in some universities. At Glasgow, as an example, the course is for twenty evenings a year for three years. It is limited to thirty-five persons. The first year is devoted to lectures on Economics, Accountancy and Industrial and Social Relations and the second to seminars with outside visitors. Some of these courses cater for directors and departmental heads while others include slightly less experienced executives.

III. ASPECTS OF MANAGEMENT EDUCATION

The remainder of this Paper will consider the experience gained in the United Kingdom of a number of aspects of management education which must always be considered in establishing any new scheme. While these various aspects have to be considered separately they are in practice closely inter-related. For example the object of a course may dictate its duration, while the syllabus and methods will be governed largely by both the object and the duration of the course. In practice, therefore, each course must be considered as an integrated whole and a change in one aspect is always likely to have important repercussions on others.

The Objects of Courses

The previous part of this Paper has shown the main levels at which management education takes place. But for any particular level the courses may have one or more of three different objects. They may seek to improve skill in specialist techniques. They may try to give a wider interest to the student's present work. They may be designed to equip the student for promotion to higher responsibilities.

The first of these objects is particularly to be found in the training schemes run by employers for their own staff. It is also found in much of the foreman's training. The second objective is perhaps shown most clearly in the Summer Schools of universities and in the adult education institutions much of whose tradition is in the teaching of background subjects. The Administrative Staff College is an example of the third type of course. These objectives need not be mutually exclusive. Subjects of general interest are rightly introduced into specialist courses and an added interest in the wider aspects of a student's present work will help to equip him for greater responsibility.

It is, of course, necessary to be clear about the objects of the course not only in order to consider its other aspects, but also in order to determine the age and status of the students to be attracted. Lack of clarity in this matter is a major criticism of the Urwick Syllabus.

Current trends in the United Kingdom seem to favour two future developments in particular. The new university courses show that need is felt for some education after between five and ten years' experience of management. This is partly to heighten and enlarge interest in the student's work and environment. It is partly also to give an intellectual framework by the aid of which he can reflect upon and more clearly analyse his experience. The second trend is to meet the need for filling the ranks of senior management from men whose responsibilities have lain mainly in specialist fields. The recent growth of institutions for this purpose in a number of European countries and plans in Australia and India for institutions similar to the Administrative Staff College show that this need is widely felt.

Admission to Courses

Where students are sent to courses with ultimate promotion in mind, they are usually nominated by their employing organization who will also pay the fees and maintain the student. At the other extreme a Technical College will admit students on an educational test.

There are arguments for and against both practices. Nomination makes for careful selection and goes far to ensure that the best use is made of the limited facilities available. On the other hand many individuals who might profitably attend courses may miss the opportunity through lack of interest on the part of their employers.

For an institution which is part of the system of public education it may be difficult to apply anything but educational tests. Such tests may help to ensure that all who wish to profit by a course have the chance to do so. On the other hand, particularly in the field of management education, there is a danger that a proportion of the students may be 'diploma-hunters' who, however diligent in their studies, lack the necessary personal qualities to make successful managers. It is of interest to note that a growing proportion of the students at Technical Colleges attend for one or two days a week instead of during the evenings. This implies a growing interest, and probably some selection, on the part of employers. At least one College consults with the employer about every student who enrols.

Examination and Certificates

The problem of whether to hold an examination or to issue a certificate, other than purely a certificate of attendance, is to some extent bound up with the system of admission.

There is always a danger that a certificate of management education will be regarded by the student as a sign of ability to manage

rather than of knowledge about management subjects and this may lead to frustration. As has already been pointed out the scheme for the award of certificates and diplomas under the Urwick Syllabus was greatly coloured by the much older systems of certificates in other subjects studied at the Technical Colleges. It is a question whether the comparison is valid.

It is of interest to note that the new university summer schools do not hold examinations or award certificates. Wherever students must be nominated by employers, the employer may be given a report upon the student but this will be based upon his personality and work throughout the course. On the other hand, if the student later wishes to change his employer a nationally recognized examination or certificate may have merit. But in the 'nominated' courses, if selection is sufficiently rigorous, attendance itself may be good evidence of the student's calibre.

The Length of Course

When a course involves the co-operation of the employer by requiring the release of the student during normal working hours, the course will succeed only if it is accommodated to the convenience of employers. The appropriate periods will depend much on local conditions. Experience in the United Kingdom suggests, however, that generally the academic year does not fit in well with the plans of employers.

For full-time courses three months appears to be the maximum limit which will be accepted. It will be seen from the preceding part of this Paper that many successful courses are conceived in terms of the working week in units of one week, two or four. Reference should also be made to the interesting experiment at Sheffield University where over a period of two years six periods of a fortnight's full-time residential study are linked by supervised reading and occasional seminars. Two adult education centres are also experimenting with a combination of full-time and spare-time study. There are, however, difficulties in finding the right methods and material for linking together the full-time periods.

Part-time courses generally require one or two evenings a week or the equivalent in day-time release. Such courses may last from one to three years. When the student is in a department which requires professional qualifications of a high order, such as accountancy, it may be unreasonable to expect to attract him to a subsequent course which makes demands on his leisure for a further period. His effectiveness as a manager might indeed be adversely affected or the course may merely attract those who hope to progress by acquiring

further qualifications. Part-time courses are naturally only possible for those within convenient travelling distance. But in many cases part-time day release may be more attractive to employers than a complete absence of the student for a period. However, most of those engaged in management education believe that there are great educational advantages in residential courses.

The Curriculum

The basic content of management studies is fairly well defined. Apart from the study of the work of specialist departments, each of which has its own practices, a curriculum will concern itself with the human relationships within an organization and the structural relationships both vertical and horizontal and with the interplay between all three. It will also contain in greater or less degree some study of the external relations of an organization not only with the public at large but also with other organizations such as Government, Trade Unions, Trade Associations and financial institutions. Experience suggests that appropriate courses can do much to create interest in and educate in these external aspects which are of growing importance.

The balance between different subjects will vary according to the object of each course. There are, however, certain general subjects affecting several aspects of management, such as economics, law and history, where there is scope for argument about how little or how much should be studied. Experience also suggests that much emphasis ought to be placed on instruction in the meaning and use of financial and statistical controls about which managers are more ignorant than is commonly supposed.

But, as Professor R. S. Edwards has pointed out, the important point is the level at which the subjects are studied and whether they develop the mind, the judgment and the character of the students. Experience suggests that the starting point must be the level of experience of the students and that throughout the course there should be a planned development to matters of increasing intricacy and difficulty which will make increasing demands on the intellectual capacity and on the character of the students. By such planning it is possible, as with the Staff College in the Fighting Services, to give students familiarity and confidence in handling situations well above their present level of responsibility.

Methods

Probably the most general generalization about the methods of management education in the United Kingdom is that nobody at

the present stage wishes to be dogmatic about any one particular method and no course confines itself to a single method.

There is, however, a general tendency towards the use of relatively small groups. The university summer schools and the adult education centres tend to think in terms of twenty-five to forty students per course. The Administrative Staff College has an upper limit of sixty. But even with such limited numbers much of the discussion will take place in smaller groups, usually of ten or less. So far as a trend can be detected it is in favour of discussion in small groups.

The information in Part II of this Paper also suggests that the greater the experience of students the higher the proportion of time spent in discussion and the lower the proportion devoted to lectures. Discussion is based on and starts from the experience of the students. It may be supplemented by talks, by visitors, by reading (although the literature of management leaves much to be desired in interest and in intellectual quality) and by a variety of visual aids.

The use of the case study appears to be increasing in the United Kingdom. Much, however, remains to be learnt about the proper methods of its use by a teacher and the conduct of discussions based on cases. There is also a marked lack of cases suitable for the discussion of policy at Board level.

Some institutions attach great educational value to the methods used and particularly to the conduct of group discussions by the students themselves. By such methods they can learn the way in which to use specialists. They have to get the group to the point of discussion within a limited time and with the material available in that time. They may also have to explain and defend the view of their group.

The Teachers

Shortage of adequate teaching staff has been the greatest handicap since the war. The dispersal of management studies among some eighty Technical Colleges has resulted in a very unequal quality of teaching. Too high a proportion of teachers have no practical experience of management. Part-time teaching staff from industry itself are still too few partly because remuneration is too low but probably mainly because few experienced managers feel that they have the vocation or techniques for successful teaching. The lack of an adequate theoretical framework has added to this handicap.

There are obvious difficulties in educational institutions attempting to compete with industry for teachers of high quality and substantial experience. For most countries the problem is not so much how to enable education to compete successfully as how to find a

different way round the problem. There is probably general agreement that, however good the permanent teaching staff, a substantial part of the teaching of management studies ought always to be done by men with current practical experience. The encouragement of senior managers to give some time to teaching has the additional advantage of securing their interest in particular courses. There is also a parallel need, not yet satisfactorily solved in the United Kingdom, for enabling teaching staff to spend a substantial part of their time in touch with current management problems.

Another way round the problem can be found where the students are themselves men of considerable experience and where the methods are based on using that experience to the full. At the Administrative Staff College the staff are not teachers in the academic sense but are experts in the facilities and opportunities offered by the College. But even here it is not easy to recruit staff of the right quality with an industrial background.

IV. THE ATTITUDE OF EMPLOYERS

In concluding this Paper it is right to emphasize that formal courses in management studies are no substitute for good management practices. They cannot correct the wrong selection of managers. They cannot be a substitute for training on the job under the eye of an experienced and sympathetic manager. Indeed for their effectiveness they depend not only upon the willingness of the student to take advantage of the course but at least as much upon the willingness of his superior to train him and to see that the benefits of the course are realized in the student's subsequent work. For this the student must be given opportunities to use his knowledge and to turn to account the wider view he has gained.

Courses of management education must be seen, therefore, as a part and only a part of the training and development of managers. For their success they require a close three-fold partnership of student, teacher and employer. Consultation at every stage is required to ensure that the course meets a genuine need, that it fits the requirements of time and subjects, that its teaching is realistic and that its results are put to good use. The United Kingdom is fortunate in now witnessing a rapid growth in industry's interest in training and a corresponding development in closer relations between industry and educational institutions.

THE ADMINISTRATIVE STAFF COLLEGE,
HENLEY-ON-THAMES

UNCERTAINTY, PRICES AND ENTREPRENEURIAL EXPECTATIONS—AN APPLIED STUDY*

by MARGARET WRAY

IN his classic analysis of risk and uncertainty, Knight[1] defines uncertainty as an uninsurable, because objectively unmeasurable, risk. The purpose of this paper is to analyse the impact of uncertainty, as so defined, on production planning and prices in an industry where it exerts a major influence on entrepreneurial decisions: the women's outerwear industry. The general approach will be largely descriptive; it is a classification of data derived from empirical research, but, to give some shape to the discussion and to the conclusions which appear to arise from it, an attempt will be made to apply some of the concepts used in dynamic theory, as they appear to be more helpful in this connection than the static analysis of equilibrium prices in which there is 'a complete neglect of uncertainty'.[2] These concepts are the production planning period, disequilibrium price fixing[3] and the nature of entrepreneurial expectations.[4]

The Women's Outerwear Industry

The scope of this paper is restricted to the narrow field of the women's outerwear industry. This can be defined as the making up of women's outer clothing from piece goods (other clothing industries, such as millinery, hosiery, underwear, boots and shoes, industrial overalls and all men's and children's clothing, are specifically excluded). The field is further restricted to wholesale production; retail production, for sale direct to the consumer, including garments made by retail dressmakers, bespoke tailors, and couture houses, is not included. The industry, as so defined, is homogeneous in that the raw materials, labour and machinery used are similar in all firms and all the products of the industry are marketed through similar channels. Its main products are dresses, blouses and tailored

* This article results from research which has been made possible by a grant under the Conditional Aid Scheme for the use of Counterpart Funds derived from United States Economic Aid.

[1] F. H. Knight, *Risk, Uncertainty and Profit*, Houghton, Mifflin & Co., 1921, page 233.

[2] G. L. S. Shackle, 'Professor Keirstead's Theory of Profit', *The Economic Journal*, March, 1954.

[3] I have based my use of these two concepts on W. J. Baumol's analysis in his *Economic Dynamics*, The Macmillan Co., New York, 1951, Chapter eight, *passim*.

[4] In this connection, the new approach to the analysis of entrepreneurial expectations in G. L. S. Shackle's *Expectations in Economics*, Cambridge University Press, 2nd Ed. 1952, in B. S. Keirstead's, *An Essay on the Theory of Profits and Income Distribution*, and in G. L. S. Shackle's paper in *The Economic Journal*, ibid., seems particularly applicable to conditions in the women's outerwear industry.

clothing. There are about 2000 factories, employing more than 10 workers in each establishment, with a considerable number of factories employing less than 10 workers. The typical factory employs about 50-100 workers. Several of the larger firms owu groups of factories and, in addition, about a quarter of the productive capacity is in the form of 'outdoor' factories, where production is on a contract basis, that is, garments are made-up on a 'cut, make and trim' or 'make and trim' basis for other firms, who supply the cloth and market the finished garments. The number of firms undertaking entrepreneurial functions is therefore considerably less than the number of factories, but they comprise a group of perhaps 1200 firms, mainly of a relatively small size. There are only 24 public companies in the industry and the typical firm is a small private company. The industry can be regarded as, generally, highly competitive, although, as will be shown later, there are some imperfectly competitive elements.

Short Period Production Planning

The planning of outerwear production is based generally on a rigidly defined six months' production period and it is proposed to relate the analysis of the effects of uncertainty to this short period.[5]

The short period for women's outerwear production is geared to a six months' retail selling season and there are two seasons per year. The manufacturer begins to plan his season's production about two months before retail selling begins. The retail selling seasons are July to December and January to June; their end is marked by half-yearly sales by retailers in January and July, when all the previous season's stocks of fashion garments are cleared at much reduced prices. At the beginning of each production season, the manufacturer decides on a range of sample garments and arranges showings for trade buyers; at the same time he secures an option on further supplies of the cloths used for his samples, in order to be able to

[5] Shortage of space prevents a discussion of the effects of uncertainty over a longer period. The omission can be justified also by the general tendency of entrepreneurs in this industry to concentrate their expectations on the seasonal production period and to undertake little investment in machinery or equipment which is not required for production in the current season. Entrepreneurs using outdoor factories do in fact live only from season to season. Entrepreneurs who hold long term contracts from multiple stores face a less uncertain future, and, from the visits I have made to their factories, have impressed me as having the best equipped factories in the industry. Generalizations are also made difficult by abnormal post-war trading and investment conditions. Many firms made considerable profits in the war and immediate post-war years and between 1947-50, there was a considerable investment in new machinery and equipment, particularly in new, development area factories. Since 1950, profits have fallen, trading uncertainty has increased and there has been little long term planning in the industry except by the entrepreneurs holding long term contracts.

meet their orders.[4] After the showing, he orders his cloth on the basis both of the firm orders taken and also of his estimates of probable repeat orders, because the trade buyers do not place orders covering all their requirements at the beginning of the season, but rely, to a large extent, on being able to secure quick deliveries of repeat orders for garments which are selling particularly well in the shops.

To meet such orders manufacturers have to hold stocks of cloth and garments. This holding of stocks by manufacturers is now much more widespread than before the war and it adds considerably to the uncertainty facing manufacturers in planning production. It has resulted mainly from the elimination of the wholesaler from the distribution chain for most types of women's outerwear. This is due to the greater influence of fashion in most branches of outerwear production in the post-war period (for reasons which will be discussed later in this paper), and of the tendency of manufacturers to by-pass the wholesaler during the war-time scarcity of clothing. The retailers, with a few exceptions, have been reluctant to undertake the stock-holding function of the wholesaler, which has therefore been passed on to the manufacturer. At the end of his production period, the manufacturer has to clear all his stocks of garments and usually all his cloth stocks, unless he chooses to take the risk of holding it until the next production season. He sells, or 'jobs', his stocks of garments at very low prices to retailers for their sales in January and July and makes his stocks of cloth into similar 'sale goods' or else 'jobs' them.

The production planning period does not, in practice, conform to the strict definitions of dynamic theory, which usually specify a much shorter period, such as a week, within which no changes are made in prices and production plans; adjustments towards a better equilibrium of demand and supply being made at the end of the week. Moreover, the production plan made by the clothing manufacturer is not in practice as rigid as in theory. The sample displays at the beginning of the season define the range of garments that the manufacturer is prepared to make during the season and the prices at which he offers them for sale. The actual volume of production and the types of garments made, are, to a considerable extent, dependent on the orders received both at the beginning and in the course of the production season. The theoretical concept of a production plan for

[4] The larger manufacturer often places firm orders for part of his cloth requirements well in advance of the production season and may make garments for stock before the seasonal sample showings, to keep factories in production, but the above generalization is applicable to the bulk of the manufacturers, who are generally small scale producers, and to a considerable part of the production of the larger manufacturers.

a specified period does, however, seem helpful in clarifying the organization of production and price-fixing procedure, because, with the reservations already noted, the production plan and prices arranged at the beginning of the season are followed for the six month's period. Prices for individual garments, in particular, are not reduced until the end of the season, as to do this would seriously weaken the manufacturer's trading position in later seasons, when buyers would not order on the basis of the sample collections but would withhold their orders in anticipation of mid-season price cuts; this would make any orderly planning of production impossible. (Manufacturers are very reluctant to reduce their offer prices to clear stocks before the end of a season. If they become particularly worried about sales, they may produce a supplementary, mid-season, sample range to encourage mid-season orders, but the aim is to offer garments with more fashion appeal rather than to cut prices.)

Short Period Pricing

The discontinuous nature of production planning leads to a corresponding discontinuity in pricing policy. Each season's prices can be regarded as disequilibrium prices, in that they represent the manufacturer's offer prices for a range of products. When the manufacturer's expectations of sales at these prices are not realized, there is an accumulation of stocks which must be cleared at the end of the season. (The explanation for this seasonal accumulation of stocks lies in the trading practices of the bulk of the retailers, who tend to give rather small orders at the beginning of the season and to rely on the manufacturers to supply repeat orders for delivery in 7-15 days. Manufacturers with small factories may be able to make the garments in this period, but they have to hold stocks of cloth in readiness to meet these orders. Manufacturers with large factories and more highly organized mass-production methods find it more difficult to make garments at such short notice and therefore hold stocks of garments to meet these orders. It is perhaps not generally realized that many of the garments sold at the half-yearly, end of season, retail sales are manufacturers' stocks, bought cheaply by the retailers.) There is, in effect, a six monthly cycle of prices and, in each production period, the manufacturer fixes a new set of prices, that are related to prices in the preceding six months through the effect of the end of season adjustment on his calculation of his offer prices for the following season.

A manufacturer's offer prices are based on estimates of 'full cost'. He first estimates the amount and cost per yard of the cloth used in each garment; then he adds the cost of the thread, buttons and other

trimmings and of the direct labour used in cutting, machining, finishing, pressing and despatching it. He usually adds a percentage, based on these direct costs, for overheads (including interest on fixed and working capital), a further percentage, based on production costs, for selling costs and, finally, a percentage to cover profits and contingencies. In the interests of realism, it should perhaps be pointed out that not all the elements in costs are separately identified by all manufacturers. (This is a point made by an accountant in the industry, with whom costings were discussed.) Costing methods tend to be rather 'unscientific' in the many small firms in the industry. Direct costs are usually estimated fairly accurately by all firms, but the difference between these costs and the offer price is often determined by 'rule of thumb' methods by the smaller manufacturers, using an intuition based on practical experience rather than on specialized cost accounting methods. But the elements in manufacturer's prices can be separately identified as direct costs, overheads, selling costs and a margin for profits and contingencies, in so far as adequate provision must be made for all these factors if the manufacturer is to remain in production.

A further complication in identifying changes in manufacturers' offer prices is the use of conventional prices or 'price lining' in this industry. For many garments, particularly in the higher quality or fashion grades, there are certain conventional prices at which garments are offered for sale to the retail customer, frequently with a guinea or half-guinea difference between each conventional price line. A manufacturer may regard these conventional prices, with a deduction for the normal retail margin and purchase tax, as given and then adjust his offer price by varying his costs — by using slightly cheaper cloth or trimmings, by making machine stitched instead of bound button-holes, by reducing his quality standards so that his passers return fewer garments to the operatives for alterations, or by reducing his advertising expenditure or the number of his travellers, to give a few examples.

These glosses, made in the interests of factual accuracy, do not affect the main argument that offer prices are based on 'full costs' and that included in this 'full cost' are not only estimates of direct and indirect production costs and selling costs but also a percentage margin for profits and contingencies. It is this last figure that invalidates the use of the 'full cost' principle as a satisfactory explanation of price fixing in this industry. It is usually a considerable proportion of the total offer price, varying from 5 per cent for cheaper garments and for garments with a relatively small fashion content to perhaps 100 per cent for the highest grade of wholesale

'model' production. An average margin for most fashion garments in the medium price ranges is about 10 per cent.[7] The margin covers not only a fair return to the entrepreneur for his services, but also the possibility — often a certainty — of considerable losses on stocks of cloth and garments 'jobbed' at the end of the season, at prices which may not even cover the initial cost of the cloth to the manufacturer.

At this stage, it may be helpful to digress a little to clarify the use of the term 'profits'. It is difficult, because of the capital structure of the industry, to use the term in its strict economic sense as the reward to the entrepreneur for his peculiar innovating and risk-bearing functions. Most firms are private companies, or partnerships, in which the entrepreneur often contributes considerable capital and management services (sometimes even labour services), in addition to his entrepreneurial functions. It seems probable that many firms do not, in fact, earn any long-term economic profit,[8] because of the high degree of uncertainty attached to production in this industry. High profits earned one season are frequently balanced by losses in a following season. But, to stay in business, a firm must earn an accounting profit, that is, it must be able to meet all outgoing expenses and, in addition, secure a sufficient return to support the entrepreneur. It is in this sense that the term 'profit' is used in this paper. The amount added to estimated costs in calculating the manufacturer's offer price for an individual garment can also be called a profit margin. But, as has already been explained, this covers both profit and contingencies and can be more accurately described as the manufacturer's 'mark-up'. It is a monetary measure of the risk or uncertainty attached to production in this industry.

Causes of Uncertainty

This forms a convenient bridge to the resumption of the main thread of the argument and to an analysis of the basis of uncertainty in this industry. There are two main causes of uncertainty in the short period, the influence of fashion and the vagaries of the British climate.

Fashion is now more important than ever before. The extremely

[7] It is difficult to obtain this information from individual manufacturers, as it is generally regarded as a trade secret and the above figures are based on information from a trade association source. 10 per cent may appear to be rather a low margin and it may well be a slight under-estimate. But it must be multiplied by at least 2 to indicate the provision for profit and contingencies over the two half-yearly seasons. Moreover, in most firms the turnover on which this margin is earned is vastly in excess of invested capital, as this industry is notorious (with the banks), for its tendency to overtrade on capital.

[8] F. H. Knight, ibid., page 365. 'The writer is strongly of the opinion that business as a whole suffers a loss.'

wide circulation of women's papers through all social classes and the publicity they now give to fashion changes, the volume of clothing manufacturers' press advertising (mainly a post-war innovation), and the more equal distribution of income, all combine to make fashion appeal a much more important influence on the sales of all types and quality grades of women's outerwear than it was before the war. Then fashion affected mainly the sales of the higher quality grades of clothing; fashions in cheaper clothing and in clothing for the older woman changed more slowly and were therefore more easily predictable. But now, fashion changes quickly affect sales in all price ranges and even older women look for fashion appeal in their clothing purchases.

The manufacturer has therefore to show a wide range of styles in his seasonal sample collection so that trade buyers may have an opportunity of using their fashion judgment in placing their orders. But even their judgment may be at fault. Couture collections, which show the newest fashion trends, are displayed some weeks after the wholesale manufacturers' trade showings, and the wide press publicity given to couture collections may have an unexpected influence on consumers' tastes. Some fashions, moreover, suddenly 'catch on' and retailers find themselves faced with a big demand for styles they have not ordered, or at least, not in sufficient quantities. Such a divergence between estimated and actual demand will have a considerable effect on mid-season repeat orders. If a manufacturer's sample range has not included the currently popular styles, his repeat orders will be small. He may wish to adjust supply to demand by offering some additional, mid-season styles, but this is often made very difficult by the need to order additional supplies of cloth for them. If he has to wait some weeks for the cloth, he will miss the season's demand. The fashion factor covers many variables; the demand may be for a particular style of garment (such as the 'H' line); a particular colour may attain sudden popularity; a type of material, such as the currently popular tweed, may be demanded, or even a trimming, such as a fur collar. A manufacturer who has not planned the production of currently popular styles at the beginning of his production season finds it very difficult to take advantage of a sudden seasonal swing in consumers' tastes, his sales suffer and his stocks tend to be 'frozen'. (Recent examples of such swings have been the use of fur collars on winter coats, which made many coats unsaleable one post-war season. Manufacturers found it difficult to add fur collars to their stocks of cloth coats, because one large firm had bought up most of the supplies of cheap furs well in advance of the season. In the last spring season, tweed costumes and

terylene/wool skirts attracted a strong consumer demand and manufacturers were anxiously chasing a diminishing supply of these cloths.)

The unpredictability of the British climate introduces further elements of uncertainty which affect particularly mid-season orders. A mild autumn discourages sales of heavy winter coats and a cold period before the July sales cuts the demand for summer dresses.

A further disturbing factor is the ease with which new firms can enter the industry. Clothing machinery is not expensive, compared with the general run of industrial equipment, moreover it can often be bought second-hand or on hire purchase, or hired, and it can be housed in very small premises. An entrepreneur can avoid even this capital expenditure by employing outdoor factories to make up his garments on a contract basis, paying for the making-up weekly, as the garments are completed. An alternative method of production is by home-workers, making-up on their own machines at home. Both these methods of production are used also by entrepreneurs with their own factories, to increase their output quickly to meet a seasonal rush of orders. It is therefore very difficult for an entrepreneur to form any reliable estimate of the season's supply of the types of garments he is producing.

Ways of Reducing Uncertainty

So far, however, this has been an over-generalized description of uncertainty in this industry. It must be qualified by an analysis of the various ways in which the different groups of manufacturers in the industry can reduce its impact.

The first qualification is that not all types of womens' outerwear carry the same amount of uncertainty, some types of garments, such as the shirt blouse, the straight swagger coat, the cheap washing dress, and outsize garments,[9] generally, are regarded in the industry as 'stable goods', because their sales are not as severely affected by fashion changes or unseasonable climatic conditions as other types of garments. Their sales, can, therefore, be more accurately calculated in advance of distributors' orders, and they can be held as stock with less risk of an end-of-season loss. Manufacturers making 'stable goods' are, therefore, faced with less uncertainty than makers of fashion garments. But, because of the relatively small risk involved in

[9] Fashion is, however, now becoming a more important influence in outsize production. More firms are entering the outsize market, because there tends to be an excess supply of stock size clothes. With the general extension of the importance of fashion, such factors as colour and skirt length are having an increasing tendency to make really 'stable' garments a diminishing part of the total supply.

their production, the 'mark-up' per garment is relatively small. Production of 'stable' garments, therefore, appeals to manufacturers with access to considerable working capital (either from their own resources or from the banks), who prefer a small, but relatively safe, ratio of profits to costs. In planning, they tend to concentrate mainly on achieving the technical efficiency which will enable them, by minimizing costs, both to offer prices low enough to ensure that they will be able to sell all their output, and to maximize their profits by minimizing costs. Specialist producers of 'stable goods' are situated mainly in the provinces, around Manchester and Leeds, or in Scotland, where there is a considerable local demand for their products, particularly from wholesalers and credit drapers who are more active there than in the South.

Fashion production, however, forms the bulk of the output of the industry. The greater uncertainties of this type of production are reflected in manufacturers' 'mark-ups' which generally increase more than in proportion to the price and fashion appeal of the garments. Manufacturers with access to only limited quantities of working capital (and this description applies to a majority of the manufacturers) are attracted by the more glittering prospects of profit from higher 'mark-ups', because they seem to offer both a bigger return on capital and an opportunity of accumulating additional capital for future expansion. These profits frequently do not materialize but, in a good season,[10] high profits are made. There are four grades of fashion goods, cheap, lower medium, upper medium and 'model',[11] with an increasing degree of trading uncertainty and a correspondingly bigger 'mark-up' as the fashion appeal and price increases.

The manufacturer of fashion garments can reduce his trading uncertainties in a number of ways. He can pass some risks back to the cloth supplier or forward to the retailer. This is a common practice amongst producers in the upper medium priced fashion group. Such firms frequently buy cloth in small quantities and at short notice, as they receive firm offers for their products. The most convenient way of doing this is through cloth wholesalers. This involves an addition of about 10 per cent to the price, but is regarded by many entrepreneurs as a fair price for the reduction in risk and the trading advantage of being able to secure small quantities of cloth at short notice. Trading risks are passed forward to the

[10] Women's clothing manufacturers have, almost by definition, highly optimistic natures; they tend to regard high profits as normal in a good season and to discount heavily the possibility of losses in future seasons.

[11] 'Model' production is a very small part of the wholesale clothing production with highly specialized production and marketing methods and so it will be excluded from the scope of the present discussion.

retailer by making garments only against orders, that is, by not making for stock. A limit is set to this passing of risks forward or backward by the high production costs of making small orders and also by the difficulty of meeting orders given at short notice, particularly in the middle of the season, unless a stock of cloth and garments is held by the manufacturer. Moreover, retailers, particularly the department stores and 'madam' shops who distribute fashion garments, tend also to reduce their stocks of these garments to a minimum and to require the completion of orders at short notice. By being overcautious a manufacturer may miss profitable trading opportunities. In practice, a firm which makes only against orders, often finds it necessary to incur heavy advertising expenditure to ensure that a large part of their season's production is ordered at the beginning of the season. But this introduces a further factor affecting uncertainty which will be discussed separately later.

Sharing Risks

Another way in which uncertainty can be met is by the sharing of risks between two manufacturers. This is common in London; often a 'principal firm' buys the cloth, and organizes the seasonal showings of sample collections and the selling of the finished garments, while an 'outdoor' contractor undertakes the making-up of the garments for a pre-arranged contract price per garment. Payments for making-up are generally made weekly, when the finished garments are delivered to the principal firm. The principal firm type of entrepreneur, in this way, avoids the risk of loss from unused production capacity, which arises mainly in the inter-seasonal periods of slack production, during about 2-3 months of the production year. His risk is restricted to the cost of the cloth, the payments for making-up services, the cost of his designers' services when he provides designs for the contractor, the cost of supervising contractors, of despatching cloth to them and collecting the finished garments (where these last two functions are not undertaken by the contractor), and, finally, the considerable risks arising from marketing the finished garments. There may be a reduction as well as a sharing of risks where the concentration of the principal firm-entrepreneur on the buying of cloth and the marketing of the garments enables him to develop a special flair for choosing cloth and for predicting fashion trends. The contractor may also reduce production risks by working for more than one principal firm so that a reduction in the demand for his services by one firm is balanced by an increased demand from

another firm.[11] The use of contractors, however, gives rise to new risks because of the difficulty of supervising their production; badly made garments may be rejected by distributors and seriously damage goodwill, particularly when garments are branded. This restricts the freedom of principal firms to reduce the risks attached to the holding of stocks of finished garments by giving contracts for making-up services at short notice. The principal firm-entrepreneur usually finds that unless he guarantees a minimum of work for his contractors at the beginning of the season (and sometimes also a minimum in the inter-seasonal slack periods), he will have to give work to the less efficient contractors whose production is of a low quality standard. A constant pressure on contractors to make garments at short notice at the height of the season will have a similar effect on quality.

'*Specialization*' *and* '*Consolidation*'

Other ways of meeting uncertainty can be grouped under Knights' headings of 'Specialization' and 'Consolidation'. An example of specialization by 'principal firms' has been given in the previous paragraph and there is a general tendency for entrepreneurs to specialize in a particular grade and type of product;[12] production is generally of a particular quality grade for which specialized skills in manufacturing and marketing methods are developed.

Consolidation is also an important factor. In the post-war period, there has been a tendency for clothing firms to increase in size. This has been mainly due to the profitability of war-time production which provided the necessary finance for expansion. In many cases there has been an increase in the size of factory to make full use of mass production methods. This increase in the size of the production unit does not necessarily reduce risks except perhaps in the case of cheaper and more stable types of garments, where mass production methods lead to considerable reduction in costs and so to highly competitive prices. But an increase in the size of the firm, in the form of either one or more large factories or a group of smaller factories, does make possible a reduction in risks through a better

[11] In practice, however, the contractor tends to be faced with an excessive demand for his services during the peak periods of seasonal production and an insufficient demand at other times. But, particularly when designing is undertaken by the principal firm, a relatively small factory is a fairly efficient production unit. The sharing of risks, in this way, therefore, permits production to be undertaken in a much smaller unit than would be necessary if the buying of cloth and marketing of the garments was also undertaken. The small size of the contractor's factories (20-50 workers is the common size compared with 100-300 for other factories), enables considerable economies to be made in overheads, so that the contractor can more easily contract production in slack periods.

[12] The four main types of products – dresses, blouses, skirts, costumes and coats – are generally made in separate factories with their own specialized production methods.

organization of marketing. The larger firm generally has a central London showroom, frequently provincial branch showrooms and a network of travelling salesmen, giving a national distribution of the firm's products.

Firms who expanded production by moving into larger factories after the war, however, have found themselves, in recent years, faced with heavier trading risks as a result of this expansion, because of the re-emergence of fashion as an important influence on sales. They have had to meet a heavy burden of overheads, including rent, maintenance of premises and machinery and the retention of a large labour force, even in slack periods. Their flexibility in meeting fluctuations in demand has been reduced, particularly when, as in some cases, production has been transferred from a group of outdoor factories to a large, 'indoor' factory. These new risks have been met either by an increased control over demand by consumer advertising, or by entering into trading agreements with the multiple stores. These include chains of dress (or 'madam') shops, department store groups and variety chain stores. Firms unwilling or unable to incur the considerable additional expenditure of consumer advertising (a fair amount of press advertising costs £30,000 p.a.) have often made such agreements, which are generally on a seasonal basis. Large orders are given at the start of the production season (sometimes a month in advance of normal retail orders), so that the manufacturer can plan his production at the beginning of the six months' season, without relying too much on mid-season orders to keep his factory fully occupied and he can often narrow the inter-seasonal gap in orders. There is a reduction of uncertainty during the season but, as the orders are seasonal, except in the case of one multiple, the manufacturer still has to face the risk of a sudden withdrawal of the expected seasonal order, which may necessitate a change in marketing methods. A firm that relies on seasonal orders from multiples has, therefore, to maintain the nucleus of a marketing organization to meet such a risk.

Consumer Advertising by Manufacturers

The use of consumer advertising, which is mainly, in fact, press advertising in the local and national newspapers and the women's magazines, can be regarded as an aspect of 'consolidation', in that it is a weapon against uncertainty which can be used most successfully by the larger firms with resources to finance an expensive advertising campaign. Advertising by women's outerwear manufacturers dates mainly from the war years, when it was encouraged by a combination of high profits and heavy taxation. The large scale advertisers,

numbering about thirty[14] for the industry as a whole, are firms which have either been established in this industry for a considerable number of years, during which they have accumulated the necessary resources for this method of trading, or, if newcomers, have connections with other industries (cloth manufacture, in one case) from which the necessary finance has been advanced; for advertising involves a considerable amount of additional expenditure on both production and marketing if the entrepreneur is to reap the fullest return from its use. A highly skilled (and well paid) administrative staff is necessary to plan production, so that supplies of the advertised garments are available at the right time and in the right district to meet the consumer demand encouraged by advertising. Strict quality standards also have to be imposed on all production to ensure that the branded garment does not disappoint the consumer and so offset the goodwill bought by advertising. The garments have not only to be ready at the factory to meet demand, they have also to be in the retail shops when the advertising appears in the press. The most effective advertising campaigns combine 'prestige' advertisements in the national press, to publicise the manufacturer's name, with other advertisements in the local press, which are timed to cdincide with deliveries to the local shops and inform the consumer about styles and prices. Consumer advertising is closely correlated to the retail selling season, that is, the advertisements appear more than two months after the start of the production season. The advertising entrepreneur has, therefore, to plan his production well in advance of demand and, in making these plans, he has to estimate the size of the consumer demand that will be provoked by his advertising. It can be seen that the entrepreneur not only has to use more capital than other producers in the industry, to make and market a given volume of production, but has also to meet new uncertainties arising from his advertising policy. But firms with adequate financial resources find it profitable to organize their production and marketing in this way and the tendency to use consumer advertising is growing. The entrepreneur finds that he can make for stock in advance of orders with more certainty that retailers will be willing to stock his products, because they are assured of a demand from the manufacturer's advertising expenditure; that is, some of the uncertainty arising from the difficulty of forecasting distributors' orders is reduced. Better production planning may also enable him to secure supplies of cloth at more favourable prices, because he orders in larger quantities and buys direct from the cloth manufacturer. The

[14] A much larger number of manufacturers brand their garments, but only this relatively small number undertake large scale advertising campaigns.

actual cost of the advertising may be reduced by sharing it with retailers, particularly for local advertising, where the press advertisements are frequently joint manufacturer-retailer ones. The entrepreneur may also be able to make some economies in other marketing costs; by, for example, closing branch showrooms in the provinces, reducing the number of travellers and concentrating selling on central London showrooms. But, even with these qualifications, the cost of advertising and the accompanying organization of production and marketing are high and advertising does not appear to enable the entrepreneur to charge much higher prices than his non-advertising competitors for garments of comparable quality. The advertising entrepreneur, therefore, has to cover his additional costs by efficient low cost production methods and by avoiding end of season losses on stocks. In so far as advertising facilitates a better correlation of production and demand, he can usually do this.

In the last two or three years, four manufacturers of branded goods, who have made a considerable use of advertising, have attempted further to reduce uncertainty by establishing direct trading contracts with the consumer. Each has opened a chain of 'shops within shops', in the form of departments in large stores, which they stock exclusively with their own products. They are, in effect, tenants of these stores, paying a rent for accommodation and services and acting as retailers, in so far as they select the stock to be offered for sale and bear the risk of loss. Such an arrangement has the advantage of rendering the manufacturer independent of distributors' orders in planning seasonal production to stock these shops. But it has the disadvantage of exposing him to the risks attaching to retail distribution. It is too early[18] to estimate whether this new development will effect a net reduction in risk for these manufacturers. But at least two manufacturers are extending their chains.

Five Groups of Entrepreneurs

It can be seen that there is a considerable variety in industrial structure and in the methods by which firms are able to 'cushion' the impact of uncertainty on their sales. Five main groups of entrepreneurs can be distinguished:

Group 1. Manufacturers of 'stable goods', who form a relatively small part of the industry and who sell to wholesalers as well as retailers.

[18] I have met directors from two of these firms and they seem very satisfied with the results of their ventures to date. But there are considerable disadvantages from combining production and distribution and executives from two department stores with considerable experience of venturing into manufacture have told me that they have found, on balance, that there was no reduction in risk, but rather the reverse.

Group 2. Manufacturers of fashion goods, in small or medium sized indoor factories,[16] who sell direct to the retailer without advertising.

Group 3. Manufacturers of fashion goods produced on a contract basis in outdoor factories, who sell direct to the retailer without advertising.

Group 4. Manufacturers of fashion goods in large indoor factories, who sell direct to retailers and undertake consumer advertising campaigns.

Group 5. Manufacturers of fashion goods in large indoor factories, who base most of their production on seasonal or long term contracts from multiple firms.

It should be noted that the largest part[17] of the industry is included in Groups 2 and 3, although both Groups 4 and 5 are an expanding part of the industry. In practice, moreover, the dividing lines between the groups are not strictly drawn, as there is a considerable amount of flexibility in the industry, which helps it both to meet trading uncertainties and maximize the opportunities for profit. Many entrepreneurs include some 'stable' garments in their production plans, as 'bread and butter' lines whose modest profits will make some contribution towards losses if the entrepreneur's expectations of profit on high fashion production are not realized. (Children's tailored clothing, for example, is frequently made by women's tailored clothing specialists as 'stable goods' to supplement their other production and to provide work for the operatives in slack periods.) Some entrepreneurs, whose production can generally be included in Group 4, make two or three grades of garments, such as low priced, unadvertised garments for sale to the multiples, medium priced, well advertised garments for sale on a national scale to local retailers and high priced garments, in advance styles, which are not widely advertised and carry a high degree of risk, for sale to the 'model' departments of department stores and 'exclusive' gown shops. This latter type of production is frequently based, not on the firm's indoor factories, which are generally highly organized for mass production, but on the use of outdoor contractors. Most entrepreneurs who supply the multiples also undertake production on their own account of some garments carrying a higher degree of uncertainty. Moreover, firms with London headquarters, who rely

[16] It is difficult, because of a lack of separate official statistics for women's outerwear, to classify the different size groups, but empirical research suggests an upper limit of about thirty workers for a 'small' factory, and of 100 workers for a 'medium sized' one and a range of about 150-1000 workers for a 'large' one, with most 'large' factories in the 150-400 worker range.

[17] At least, the largest number of entrepreneurs. Lack of official statistics prevents any estimate of value or volume of production in the different groups.

on their own production to meet the bulk of the demand, frequently use outdoor factories to meet additional orders during the season, as the extension of their own production units to cover the peak seasonal demand would involve unduly heavy overheads in the inter-seasonal periods when their factories were not in full production.

In any realistic analysis of the industry, therefore, a clear cut distinction cannot be drawn between the different types of entrepreneurs, but generally they can be classified into the five groups described above. In each group they are faced with different kinds and degrees of 'irreducible uncertainty' which remains after they have taken all possible action, on the lines indicated, to minimize trading risks. It is in connection with the effect of this 'irreducible uncertainty' that Shackle's analysis of expectations seems to be particularly helpful in explaining entrepreneurial actions in this industry.

Entrepreneurial Expectations in the Short Period

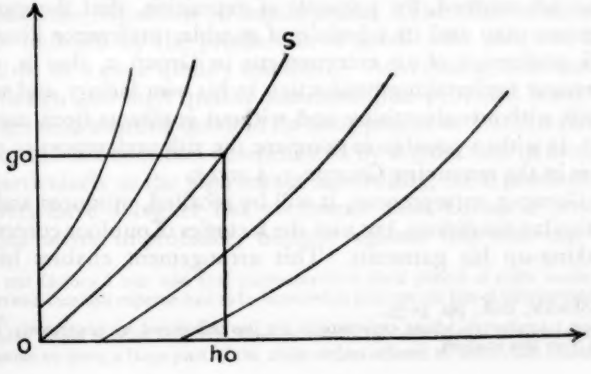
Both Shackle and Keirstead have applied this analysis mainly to long period decisions affecting investment in capital equipment, rejecting the apparatus of numerical[18] probability estimates of the results of the alternative courses of action hypothetically open to the entrepreneur, erected by many economists as a basis for reaching such decisions, on the grounds that firstly, the facts collected from past business experience are insufficient to provide a basis for such estimates and, secondly, as the decisions to be made are unique or quasi-unique, such probability estimates are irrevelant. (Shackle, ibid., page 127 and Keirstead, ibid., pages 18-19). These considerations seem equally applicable to entrepreneurial decisions in planning the investment of working capital in the short period of the six months' season in the women's outerwear industry. For, in each season, the main grounds for uncertainty — fashion, climatic conditions and the difficulty of estimating the volume of production of the different types of garments — combine to make past experience an inadequate guide to future action and to make the entrepreneur's decisions regarding production in each season unique. The argument against the use of probability estimates can be reinforced from a knowledge of entrepreneurial psychology in this industry. Entrepreneurs, who frequently do not base even their prices on 'scientific' costing methods, are still less likely to make elaborate calculations of the probabilities of profit from alternative production plans a basis for determining their seasonal production planning. Shackle's approach to expectations is a much more realistic one. For, as Keirstead comments (ibid., page 19), 'The entrepreneur's decision is

[18] Shackle, ibid., Chapter VII, *passim*.

not determined by rational calculation of the chances, which in the nature of the situation he cannot make, but probably, by something closer to the artist's flair than the scientist's calculation.' Knight, moreover, commented earlier, 'We act upon estimates rather than inferences, upon "judgment" or "intuition", not reasoning for the most part' (ibid., page 223).

Shackle's analysis of entrepreneurial expectations is an explanation of this intuitive approach. (For a full account of this analysis cf. Shackle, ibid., Chapter II, *passim.*) He uses two determinants, the 'potential surprise' resulting from the anticipation of the outcome of a given course of action and the degree of feeling, either enjoyment or distress, which results from this anticipation. In considering alternative production plans, the entrepreneur concentrates his attention on the two points of potential loss or gain which cause the greatest intensity of feeling about the prospects of gain or loss; these Shackle terms 'focus gain' and 'focus loss'. The entrepreneur, he argues, will tend to reject plans which have too strong an element of surprise as being too unlikely to happen; his wilder imaginings are tempered by his innate feeling for trading opportunities, so that the possibilities which afford the most stimulus in translating anticipations into action are ones in which the surprise factor is modified by his belief in the possibility of success resulting from his actions. In considering alternative production plans, the entrepreneur will concentrate, or focus, his attention on the two points that, for each plan, summarize the possibility of loss or gain. In choosing between the plans he will select the combination of potential loss and gain which is most attractive to him. The process by which this choice is made is illustrated in diagrammatic form on a 'gambler indifference' map.

Such a map (cf. Shackle, ibid., page 30) can be drawn to show the risk preference of any given entrepreneur as follows:



On this map the focus gains are measured on the vertical axis and the focus losses on the horizontal axis. Any point on the map will indicate a combination of focus loss and focus gain arising from the entrepreneur's expectation of the outcome of any given production plan. For the entrepreneur, a series of continuous indifference curves can be projected on this map and these must slope upwards from left to right, as an increase in focus loss must be compensated by an increase in focus gain, if the alternative production plans represented by points on a single indifference curve are to be equally attractive. In considering alternative plans the entrepreneur will select the one offering a combination of gain and loss which, as represented by a point on the map, reaches the highest indifference curve, that is, the one nearest to the vertical axis.

As a further refinement, Shackle develops the idea of a 'schedule of gambler preference', based on an 'origin indifference curve' which passes through the origin and is represented by OS on the diagram; points on this curve indicate combinations of focus loss and focus gain that are neither more nor less attractive than the combination at O, where there is neither gain nor loss, so that, at all points on this curve, 'the focus gain compensates the focus loss'. This origin indifference curve provides a 'schedule of gambler preference' for any given entrepreneur, the schedule being the ratio of focus gain to focus loss, as measured along the horizontal axis of the diagram. This is illustrated on the diagram by variable point ho/go (ho).

'Gambler preference' provides a convenient technique for comparing the degree of uncertainty in the expectations of the different groups of entrepreneurs[19] (as listed on page 18); the greater the uncertainty (or 'gambler preference'), the larger will be the 'mark-up' added to the costs of production and sale to cover trading contingencies.

It can be assumed, for purposes of exposition, that the gambler indifference map and its schedule of gambler preference illustrates the risk preference of an entrepreneur in Group 2, that is, of an entrepreneur undertaking production in his own factory and selling his goods without advertising and without contracts from multiple firms.[20] It is then possible to compare the risk preferences of entrepreneurs in the remaining Groups, 3, 4 and 5.

The Group 3 entrepreneur, it will be recalled, produces and sells under similar conditions, but uses the factories of outdoor contractors for making-up his garments. This arrangement enables him to

[19] Cf. Shackle, ibid., pp. 31-35.

[20] Group 1 producers, whose expectations are less influenced by uncertainty, can be excluded from this analysis.

make his output more flexible to demand because he is not restricted to either an upper or a lower limit to production, as set by the productive capacity of an indoor factory. There are limits to this flexibility, but it can be generally assumed that he will not be faced by the problem of whether or not to produce garments for stock, in considerable excess of orders, to keep his production unit fully employed. He will have to hold some stocks of cloth and garments, but they will probably be lower than those held by the Group 2 entrepreneur and, in addition, if he finds it necessary to cut production because of lack of orders, he will not be faced with losses from continuing overheads and wage payments to a nucleus of workers, retained to make possible a resumption of production when trade improves.[21] It can be seen that, for a corresponding focus gain, a Group 3 entrepreneur will have a lower focus loss than a Group 2 entrepreneur, indicating a reduction in risk preference and a lower gambler preference schedule, which, if illustrated on a similar indifference map, would be above and to the left of OS on the diagram.

The Group 4 entrepreneur produces his goods in his own (indoor) factory but makes a lavish use of consumer advertising. He therefore has a different approach to production and marketing, in that he seeks to adapt demand to his productive capacity rather than to make output flexible to demand. He estimates the volume of garments that his factory can produce in a season and plans, by advertising, to ensure that the corresponding demand will materialize. He does this by organizing his advertising when he plans his production and then using his advertising programme as an incentive to persuade trade buyers to give large orders at the beginning of the production season. It seems generally agreed in the industry that advertising expenditure does reduce, although it does not eliminate, the risk of loss on unsold stocks. (The effect of advertising can be nullified by the production of goods with deficient fashion appeal or of a poor quality standard.) Advertising, combined with good design and high quality standards, has provided many entrepreneurs with a strong demand for their products.[22] If this reduction in focus loss is more than compensated by a reduction in focus gain, due particularly to the high cost of advertising, these producers will, however, have a higher risk preference than Group 2 producers. But this seems improbable, because against this cost can be set

[21] In one factory I was told that payments in a slack period of eight weeks totalled £30,000 and that this expense had to be incurred to prevent the loss of irreplaceable skilled workers.

[22] I have found that at least two firms to which this description is applicable are, in fact, unable to meet a large part of the trade orders offered to them each season.

considerable economies in production costs made possible by the better planning for bulk production facilitated by advertising. Moreover, the use of advertising may permit economies in other selling costs and also an increase in selling prices to the retailer, which is not passed on to the consumer. (This can be justified by the reduction in retailers' selling risks which results from manufacturers' advertising.) The best way of minimizing advertising costs is probably by spreading advertising over as large a production as possible and most entrepreneurs in Group 4 have exceptionally large production units. On balance, therefore, it seems reasonable to assume that there is no reduction in focus gain, so that the risk preference of Group 4 producers will be lower than that of Group 2 producers and their gambler preference schedules will be above and to the left of the line OS in the diagram.

The Group 5 producer is comparable in size to many of the Group 4 producers and produces his goods in indoor factories, but he bases his marketing on large contracts from multiple firms. The large size of the orders given by these firms, particularly when they are placed at the beginning of the production season, enables this type of entrepreneur to make plans involving a lower focus loss, that is, the risk of losses from the possible 'jobbing' of unsold stocks will be reduced. But multiple contract prices are keen; often a multiple firm will cost garments themselves before agreeing to a manufacturer's offer prices. A Group 5 entrepreneur has, therefore, to make his production unit very efficient to make a good profit from multiple contracts. But it seems probable that the economy in selling costs resulting from such contracts and the use of mass production methods, which can be most successfully applied when large orders are booked at the beginning of the season, will more than offset any reduction in focus gain from keen pricing. The Group 5 entrepreneur will therefore have a lower risk preference than the Group 2 entrepreneur.

Uncertainty and Prices

It can be concluded that the Group 2 entrepreneur has the highest risk preference; it follows that his prices will generally include a higher 'mark-up' on production and selling costs to cover his higher risks. Prices will tend to be further inflated by relatively inefficient production methods, compared, that is, with Group 4 and 5 producers. (These are inefficient, not necessarily because of the small size of the entrepreneur's production unit, but because of the small size of the individual trade orders and the difficulty of co-ordinating them, in the absence of advertising.) It can be seen, therefore, that

Group 2 entrepreneurs tend to be in the weakest trading position. (This generalization applies to the cheap and lower medium grade production that comprises the bulk of current women's clothing output. For upper medium grade production, where all retail orders are small and where advertising has less consumer appeal, the Group 2 entrepreneur is in a relatively strong trading position.)

It is more difficult to compare the prices of Group 3 and 4 entrepreneurs. Empirical research indicates that outdoor production is a surprisingly low cost method of production, because of low overheads and because the proprietors of outdoor factories contribute important managerial and skilled craft services which other producers can only secure at a high cost. It seems probable, moreover, that advertising expenditure merely brings a reduction in risk comparable to that secured from the greater flexibility in meeting changes in demand and the opportunity of passing on part of the risk to the outdoor factory proprietor, enjoyed by the principal firm type of entrepreneur. There is, however, a long term advantage to the Group 4 entrepreneur, which does not fit into this short period analysis but should be noted, in that his advertising is building up a long term goodwill for his products that will facilitate future production planning. There is also a social advantage, which can be regarded as a reduction in the social costs of clothing production, resulting from the fact that the Group 4 manufacturer reduces risks, whereas the Group 3 manufacturer passes them on to the outdoor contractor, who, in turn, passes them on to his workers in the form of short time working and unemployment. Moreover, working conditions are appalling in many of these factories.

The Group 5 entrepreneur appears to offer the best value, because his 'mark-up' includes only a small margin for risks, because of the economy in selling costs resulting from his dependence on multiple contracts and because of the efficient, low cost production methods that such contracts encourage.

Conclusions

It is hoped that this analysis of short period uncertainty and prices has demonstrated both the complexity of the pricing system in this industry and the importance of factors that cannot be identified in a static analysis of equilibrium prices. It seems clear that the entrepreneur, who on the basis of the static type of analysis might appear the most economically desirable — the medium sized producer, who sells on a freely competitive basis — does not, in fact, sell at the lowest prices (for garments of comparable quality). More efficient are producers whose activities are on a less freely competitive basis,

because of the use of consumer advertising or because of an increase in the monopsonistic power of the large retailer. A possible exception to this generalization is the case of the principal firm type of entrepreneur, who organizes production and reaps its fruits but takes only a partial responsibility for losses. In the short period he appears to be admirably adapted for survival in an uncertain industry, but it should be pointed out that, apart from welfare considerations, this type of entrepreneur has a discouraging effect on technical progress and so on long term reductions in costs and prices. Moreover, under present conditions of full employment, outdoor factories, with their often squalid working conditions and insecurity of employment, are tending to disappear because of the difficulty of recruiting and retaining operatives.

An attempt has been made to substitute some of the tools of dynamic economics for the tools of static equilibrium analysis. This has proved difficult, as dynamic theory is at present ill-adapted for application to micro-economic problems. But perhaps this attempt has indicated that there is further scope for the application of dynamic theory to industries where uncertainty exerts a strong influence on entrepreneurial planning and prices.

UNIVERSITY COLLEGE, LONDON

A SURVEY OF THE ANNUAL COSTS OF CONTRACTORS' MECHANICAL PLANT[1]

by P. A. Stone

INTRODUCTION

In the absence of information on the maintenance and replacement costs of contractors' mechanical plant, and on the way these costs vary with use and with changes in the levels of prices, it is difficult to decide under what conditions, or to what extent, it is economic to use plant, or to choose between different types of plant. A survey has, therefore, been made recently in order to provide such data.

A pilot inquiry was first made amongst contractors and local authorities with whom the Building Research Station had worked on other investigations. It was found that the range and number of items of mechanical plant decreased with decreasing size of the undertaking, as measured by the number of operatives employed, even more rapidly than might have been expected. Furthermore, the smaller firms did not usually keep records of the costs and use of their plant in a form suitable for the purpose of this inquiry. The larger undertakings usually pursue a policy of preventive maintenance which necessitates inspections and frequent rebuilds, while the smaller undertakings more often await the need before carrying out repairs, so that their figures, even if available, would not measure the costs of the same standard of maintenance. It was decided, therefore, to limit further inquiries to the undertakings employing at least 1000 operatives.

THE SAMPLE

In all, seventy-two contractors and forty-seven local authorities were approached. Some of the contractors were found to be operating also as plant hire firms, and since it was not known how far this activity might affect the maintenance costs, a few plant hire firms were included. Three-quarters of the undertakings agreed to co-operate and an interview was arranged with most of these. During the course of these interviews the problems of plant management and costing were discussed and records were examined. Valuable background information was obtained even where the records proved to be unsuitable for the particular purpose of the survey. The proportion of undertakings with unsuitable records was twice as great for the smaller undertakings as for the larger. Data were obtained in all

[1] Crown Copyright reserved.

from fifty-four undertakings. This is considered a satisfactory result for an inquiry of this sort.

THE INFORMATION COLLECTED

The information required for each item of plant was as follows:

(*a*) Specification of plant and accessories, e.g. type, size, manufacturer, fuel.
(*b*) Date of purchase and price, and whether new or second hand.
(*c*) If sold or scrapped, date of disposal, and price if any.
(*d*) Net annual expenditure on repairs and maintenance, year by year, for as long as possible. This item includes the cost of repairs, overhauls and rebuilds, but not that of greasing, cleaning and other day-to-day maintenance carried out by the plant operator. Where the figures for net labour and materials were not available the gross figures, including overheads, were taken.
(*e*) Percentage added to repair and maintenance costs to cover labour on-costs, workshop overheads, administration and storage.
(*f*) Annual working time, year by year, for as long as possible.

The groups of plant about which information was collected were:

1. Mixers and mortar mills.
2. Material hoisting plant, e.g. cranes, hoists, elevators.
3. Material moving plant, e.g. conveyors, powered barrows, monorail trucks.
4. Earth moving plant, e.g. dumpers, excavators, shovels, trenchers, scrapers, dozers, tractors.
5. Powered tools, e.g. hammers, saws, paint sprays.
6. Compressors and compressor tools, e.g. breakers, rammers.
7. Pumps.
8. Rollers.

Thus all the main types of contractors' mechanical plant were included, only such specialized items as road surfacing equipment and piling equipment being excluded.

Most of the data obtained were in respect of the period 1950-53, although a few undertakings were able to provide data for a considerably longer period. Some idea of the extent of the information can be gained from the fact that maintenance costs covering about 20,000 machine-years were obtained.

ANALYSIS OF THE DATA

The object of the analysis is, of course, to build up estimates of the various categories of expenditure, which arise in the use of contractors' mechanical plant. Because of their differing nature, however, the data relating to the various factors require somewhat different treatment. It should be emphasized that the present paper is concerned with the costs of owning and managing a plant pool; running costs, including such items as the wages of the plant operators, consumable stores and day-to-day maintenance are excluded.

Maintenance

The chief factors likely to affect maintenance costs are the levels of prices, the age of the machine, and the way in which it is worked. The effects of changing levels of prices can be removed by revaluing the annual maintenance costs on the basis of the prices at the original year of purchase. It is not, of course, possible to revalue each item of maintenance separately; to do this it would have been necessary to have had complete records of the labour and material content of each job. Instead, each annual total for maintenance was multiplied by the ratio:

$$\frac{\text{the index measuring the general level of maintenance costs in the original year of purchase}}{\text{the index for the year to which the maintenance expenditure refers}}$$

This index, Table I, measures the changes with time in the costs of carrying out similar repairs. Theoretically it should be based on the prices of spares and raw materials and the labour rates of fitters and fitters' labourers. In fact, it was not practicable to obtain the prices of spares, or for that matter, the prices of machines on the scale that would have been necessary.

The index finally used was based on 'fitters' and 'fitters' labourers' wage-rates,[1] and on the price indices[2] for 'iron and steel' and 'non-ferrous metals'. These wages and price indices were combined with weights 48; 28; 20 and 4 respectively. The proportion of 'fitters' to 'fitters' labourers' is that used by Bowley, and that between 'iron and steel' and 'non-ferrous metals' is taken from the Board of Trade Wholesale Prices Index of Mechanical Engineering Materials. The relationship between labour and materials was based on an analysis

[1] Bowley's Index of Wage Rates for Engineers – *London & Cambridge Economic Service Bulletins.*

[2] Index of Wholesale Prices – Board of Trade.

of maintenance expenditure, and material from the Census of Production. Various combinations were tried but since the various basic indices did not, over the period of prime importance, move much out of step (Fig. 1) changes of weight did not make any important differences to the final index. Similarly the index was not

TABLE I

MECHANICAL PLANT — MAINTENANCE COST INDEX
1953 = 100

Year	*Maintenance Cost Index*	*Year*	*Maintenance Cost Index*
1921	53	1938	43
1922	37	1939	44
1923	38	1940	49
1924	38	1941	52
1925	37	1942	55
1926	37	1943	59
1927	38	1944	61
1928	37	1945	64
1929	38	1946	69
1930	37	1947	71
1931	37	1948	75
1932	37	1949	76
1933	37	1950	83
1934	37	1951	86
1935	38	1952	101
1936	39	1953	100
1937	42		

sensibly changed by the inclusion or exclusion of the marginal materials. The final index (Table I) agrees reasonably well with the limited information, which was available, of changes in the price of plant.

Differences resulting from variations in size and model can be readily removed by expressing the deflated values as percentages of the price of the machine when new. Some of the figures obtained included overheads; the percentage which had been added was ascertained and this element was removed by multiplying the figures by the ratio of net to gross costs. The resulting net maintenance cost percentages express the annual maintenance cost as a percentage of the price of the machine when new. For example, if a given mobile diesel crane, bought new in 1948, had a maintenance cost of £160 in 1951, then the net maintenance cost percentage for that year would be calculated as follows:

Expenditure in 1951 including overheads = £160
Maintenance cost index for 1948 = 75
Maintenance cost index for 1951 = 86

(*Ctd. next page*)

$$\text{Deflated value} = £160 \times \frac{75}{86} = £139{\cdot}5$$

$$\text{Price of the machine when new} = £1000$$

$$\text{Percentage of overheads included} = 25\,\%$$

$$\text{Net maintenance cost percentage} = \frac{139{\cdot}5}{1000} \times \frac{100}{125} \times 100 = 11{\cdot}2\,\%$$

The annual maintenance cost percentages, even when adjusted as described above, are bound to be extremely variable. Machines remain in use for several times as long as the life of most of their moving parts and the lives of the moving parts themselves vary considerably one from another. The annual costs, therefore, reflect the gradual replacement of the machine parts and the special costs of inspections and overhauls of varying intensity. It is thus to be expected that the maintenance percentages even for the same undertaking and for similar plant will show a high degree of variability — this was borne out by the data from the survey. Variability can also arise from differences in the way the plant is handled and maintained, and from the types of, and extent of, use.

The net maintenance cost percentages were grouped according to machine type and year of age, and within each machine type separate sub-groups were formed for each size of machine and type of fuel used. Initially the data of each undertaking were kept separate within the sub-groups. The percentages for each sub-group were then examined to see how far their levels were common to all the undertakings from which observations were obtained, inquiries were made as to the reasons where the level of the percentages was found to be unexpectedly high or low, and the figures for such undertakings excluded if the conditions appeared to lie outside the normal expected experience. In fact, only two or three sets of data had to be excluded in this way and in each case a combination of unusual circumstances had arisen. The next step was to examine the levels of percentages for different sizes and fuels for a particular type of machine. Unless the differences appeared to be both real and of practical importance the size and fuel groups were combined. Finally the average level of the maintenance cost percentages throughout the life of the plant was determined.

Life

Plant can have no natural 'life' since at one extreme the identity of an item of plant can be extended almost indefinitely by replacing one component after another, and at the other extreme a machine may be scrapped, even though mechanically reliable, because a new and

relatively more efficient machine is placed on the market, or because the use that the machine was designed to serve no longer exists. All that can be attempted is to define 'life' in terms of current practice in relation to scrapping.

Two sets of figures are available from which to determine life, the age distribution of plant in existence, and that of plant scrapped. Neither of these, however, is in itself a sufficient measure of life. The former reflects the rate at which new plant has become available as well as the rate at which it has been scrapped, and while it provides evidence that plant is kept at least to the extreme age of the distribution, it does not, of necessity, indicate how typical this is, or whether or not plant is kept to greater ages. The numbers of plant scrapped at the various years of age are materially influenced by the age distribution of the existing plant. However, if the number scrapped is expressed as a ratio of the number at risk, for each year of age, a measure of the probability of scrapping can be obtained, which is not biased by the accidents of the distribution of the existing plant ages. These probabilities are, of course, appropriate to the period over which the rates of scrapping have been observed, namely, from 1950 to 1953.

Probabilities, especially when small, are very sensitive to small movements in the number of events observed and very large numbers of observations are necessary in order to obtain stable measures of probabilities. Although many thousands of observations were obtained in this survey, the numbers were not really adequate, when the observations were divided into each year of age, and into the main types of plant. In order to remove any inaccuracies due to mis-statements of the year of manufacture, each probability was calculated as the average of the two years preceding and following, as well as that for the year of age under study.

The observed probabilities are, of course, still only a measure of the way plant was scrapped by the undertakings from which the observations were obtained. It is desirable to forecast the way plant will be scrapped in general by undertakings operating under similar conditions. The limits within which such probabilities lie can be estimated from the data. In addition, the maximum ages of observed plant were available and it is known that such probabilities increase with age in a regular manner. Curves were, therefore, fitted through the observed probabilities and made to reach unity at an age consistent with that of the oldest plant found in the survey. These probabilities were then applied to hypothetical populations of 100,000 items of plant and the numbers scrapped and remaining at each year of age were computed. Finally the replacement costs were

calculated; these are the average costs of replacing scrapped plant over the life of a fleet.

Usage

These data were available either as a record of site time, divided into working, idle and broken-down time, or as a record of site and yard time; sometimes both were available. These analyses were available in hours, or sometimes in days, and usually separately for each item of plant. The data were analysed within each category by machine class, and in years of machine age. Finally, the data were collated on the basis of a year of 2200 hours.

Overheads

The various overheads arising in connection with the fitters' shop and plant administration were collected in as great detail as possible and were then collated in itemized tables so that as much use as possible could be made of incomplete information. Estimates of the overheads were then built up from a sum of the separate estimates for the various components of cost.

THE RESULTS

Maintenance Costs

Expenditure on maintenance will depend, to some extent, on the ages to which plant is kept. If plant is scrapped after a few years the level of average annual maintenance costs will be comparatively low, since very few of the components will need replacing. The longer the plant is kept, the greater the proportion of components which will require replacing, and the greater the proportion that will need replacing several times. The survey showed that plant was being kept for comparatively long periods, probably for the length of life of the frame and other main non-moving parts. The way the percentages of maintenance to price of machine when new changed with age, is illustrated by Fig. 2. It will be seen that they follow broadly the pattern which might be expected, but the behaviour of the heavy tractors is somewhat anomalous. The maintenance percentages can be expected to fall towards the end of the life of the plant, since it would not be economic to replace components, if at all avoidable, immediately prior to scrapping.

Data were usually available for both local authorities and contractors, and it was, therefore, possible to compare the levels for the one type of undertaking as against the other. For only four types of plant did there appear to be any real difference but in each case the local authority level was the lower. The differences seem to be

associated to some extent with the type and conditions of work undertaken.

The estimated annual net maintenance percentages are set out in Table II. The figures given are usually the arithmetic means of the observations but where necessary an adjustment was made to allow for a disproportionate number of observations at certain ages. The figures support the usual contentions as to the relative maintenance costs of plant fitted with engines using the different fuels. Petrol driven plant has always the highest costs; diesel plant has usually

TABLE II

ANNUAL NET MAINTENANCE COST PERCENTAGES

Type of Plant	*Net Maintenance* Cost Percentages*				*No. of Observations† Available*			
	Petrol	*Diesel*	*Electric*	*Steam*	*Petrol*	*Diesel*	*Electric*	*Steam*
Mixers and Mortar Mills								
Mixers: Local Authorities	7	6	—	—	1012	150	—	—
Contractors	13	12	11	—	930	531	—	—
Mortar Mills	17	15	—	—	104	—	—	—
Material Hoisting Plant								
Cranes: Mobile	10	8	—	—	—	722	—	—
Derrick	—	—	4	4	—	—	158	—
Rail Mounted	—	—	4	4	—	—	—	88
Rail Mounted Tower	—	—	4	—	—	—	—	—
Hoists	9	8	7	—	123	117	—	—
Material Moving Plant								
Dumpers: Local Authorities	5	3	—	—	121	203	—	—
Contractors	13	11	—	—	478	—	—	—
Levelling and Digging Plant								
Excavators	—	9	—	—	—	1060	—	—
Tractors: Local Authorities	10	9	—	—	99	94	—	—
Contractors	17	16	—	—	—	395	—	—
Shovels and Loaders:								
Local Authorities	11	—	—	—	419	—	—	—
Contractors.	18	—	—	—	56	—	—	—
Trenchers	—	9	—	—	—	52	—	—
Powered Tools								
Hammers	—	—	16	—	—	—	125	—
Saw Benches	12	—	5	—	63	—	—	—
Hand Saws	—	—	16	—	—	—	—	—
Compressor Equipment								
Compressors	11	8	6	—	182	970	227	—
Independent Compressor Tools	7	—	—	—	670	—	—	—
Pumps								
Concrete Pumps: (Mechanical)	—	9	9	—	—	46	57	—
Water Pumps:								
Local Authorities	7	—	—	—	363	—	—	—
Contractors	18	—	17	—	521	—	199	—
Rollers	7	6	—	4	1111	1287	—	896

* The cost of day-to-day maintenance is not included in the above figures.

† If no figure is given it indicates that the number of observations was too small, or too badly spread over time, to provide any valid evidence on its own, and that analogies with other types of plant have been used as well in estimating the ratio.

greater costs than electric although in one or two cases there was no clearly marked difference, and in general, electric and steam driven plant have about the same maintenance costs. Of course, the relative difference will depend on the relation of the engine costs to those of the rest of the machine. The percentages did not appear to vary with the size of the machine.

Life of Plant

The relative numbers scrapped at each year of age are determined by a number of factors. Plant is naturally heterogeneous and some will fail mechanically during the early years of life and not be worth repairing, although the bulk of the machines, provided they are properly maintained, will have a long useful life. Some plant, otherwise worth repairing, will, of course, be scrapped as obsolete. The actual ages to which plant can usefully be kept will vary with the construction of the plant and the methods of working it. The length of life is also determined to an important degree by management policy; it is believed that at one time plant was regarded more as a consumable than as a capital asset, but today careful use and maintenance is general practice and as a result the life of plant is much greater than was perhaps once usual. The average life of most types of plant is now of the order of fifteen to twenty years; for steam plant it is rather longer. The probabilities of scrapping do not approach unity in most cases earlier than the early twenties (Fig. 3) and the maximum rates of replacement do not usually occur before the plant is twenty years old (Fig. 4).

The replacement cost percentages are the average amounts which must be set aside each year in order to replace the members of a fleet of plant as they are scrapped. During the early years after the purchase of the plant the amounts thus set aside will be more than required to meet the costs of replacement and the excess will accumulate in a fund which will earn interest and which will be drawn upon in later years when the annual replacement costs will be greater than the amounts set aside annually. In practice the amount available in the fund will be used to offset temporarily part of the loan initially taken to purchase the plant. This is financially equivalent to the sum in the replacement fund being invested at the interest rate applicable to this loan. It will be appreciated, of course, that the replacement percentage gives the average charge; for single machines the reserve may be greater or less than that needed but the difference between the actual and predicted reserve will lessen as the pool of machines increases; the fact that the machines will be of different types and ages does not affect the averaging process.

The replacement percentages are set out in detail in Table III. Those based on observed probabilities of scrapping (Figs. 3 and 4) are starred. As explained earlier, large numbers of observations are necessary in order to obtain reliable estimates of the probability of scrapping, and the observations must be reasonably spread over the

TABLE III

REPLACEMENT COST PERCENTAGES

Type of Plant	*Percentage of Current Initial Cost to be taken as the Annual Charge when capital is borrowed at a rate of interest of:*		
	4 per cent	*4½ per cent*	*5 per cent*
Mixers and Mortar Mills			
*Mixers	4.30	4.15	4.00
*Mortar Mills	4.80	4.65	4.50
Material Hoisting Plant			
Cranes (Derrick and Rail Mounted)	1.40	1.30	1.20
*Cranes (Mobile)	3.75	3.60	3.45
Conveyors, Elevators, *Hoists and Winches	3.00	2.85	2.70
Material Moving Plant			
*Dumpers and Powered Barrows	4.95	4.80	4.65
Levelling and Digging Equipment			
*Excavators	3.15	3.00	2.85
*Tractors and other Tractor-based equipment	3.85	3.70	3.55
Trenchers	4.95	4.80	4.65
Powered Tools			
*Electric Hammers	4.70	4.55	4.40
Sawbenches	3.00	2.85	2.70
Compressor Equipment			
*Compressors	3.15	3.00	2.85
*Breakers, *Rammers, *Vibrators and other self-powered compressor tools	4.25	4.10	3.95
Pumps			
Concrete Pumps	4.30	4.15	4.00
*Water Pumps	3.50	3.35	3.20
Rollers			
*Petrol or *Diesel	2.70	2.55	2.40
*Steam	1.40	1.30	1.20

* Based on observed probabilities of scrapping

possible life of each type of plant. These conditions were satisfactorily fulfilled for some types of plant, and in some other cases the data were considered sufficient, when taken together with an appraisal of the mechanical structure of the machines, to justify linking the plant types with those for which adequate data were available.

It will be noticed from Table III that small changes in the rate of interest assumed make little difference to the size of the replacement percentages. Over most of the range of the plant considered the percentages fall 0.15 for an increase in the rate of interest of 0.5 per

cent, although this relationship will not hold good much beyond the limits shown in the table.

No allowance has been made for the scrap value of the machines since such values are generally very low, representing only a few per cent of the initial value of the plant, and are subject to fairly wide fluctuations in accordance with the value of scrap metal. It is suggested that any scrap value obtained can be credited to the reserve as a contingency allowance.

For normal accountancy purposes, plant is often written off over very short periods, say four or five years or even less. These periods bear little relation to the actual life of the plant and their use has the effect of increasing the apparent annual costs over the period of depreciation by around 50 to 100 per cent. Any plant sold relatively early in its actual life leads generally to a substantial adjustment in the reserve fund. Less distortion arises if the depreciation rates allowed for tax purposes are used, since the expectations of life upon which they are based lie fairly close to those established above. Although this procedure is fundamentally different from that set out in the present paper and results in very different levels of replacement charges for individual items of plant, the average charges will be much the same by either method if the fleet is large and well-balanced in terms of plant ages.

Usage Rates

The information on usage is less well substantiated than the information on costs. This is partly because the variables measured are less precise and the quantities based on site observations, and partly because only a small proportion of the undertakings collated the usage data in a form suitable for analysis. The information given in Table IV indicates, for local authority plant, no marked differences in the working time for various ages; such figures as were available for contractors' plant similarly supported the opinion that properly maintained plant remains mechanically reliable to an advanced age. The data for local authority plant suggest that the usage rates for dumpers, excavators and shovels decline at an average of just over 30 hours for each year of age. For other types of plant the rate of decline is even less marked. Perhaps more striking is the low level of working hours which the figures indicate as normal; the level is lower for local authorities than contractors, particularly for heavy plant (Table V). Site time is, of course, much greater than working time (Table VI). The difference between the two is mainly idle time, since recorded site break-down time is only about fifty hours a year for most types of plant.

TABLE IV

CHANGES IN WORKING TIME WITH AGE FOR LOCAL AUTHORITY PLANT

(*Average hours worked per year*)

Age (years)	0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54
Type of Plant											
Mixers	500	500	400	300	300						
Mobile Cranes	900	800	200	1100	1400						
Dumpers	900	800	300	500							
Excavators	1200	800	1000	900							
Tractors, etc.	1100	900	900	1100							
Compressors	1000	1000	1000	900							
Independent Compressor Tools	300	200	200	300							
Water Pumps	300	200	100	100	100	100					
Rollers (Petrol and Diesel)	1300	1100	1000	1000	900	800					
Rollers (Steam)	—	1000	1400	1300	1400	1100	1100	800	900	600	1100

TABLE V

AVERAGE ANNUAL WORKING TIME (HOURS)

Type of Plant	*Local Authority*	*Contractor*
Mixers	500	600
Mortar Mills	—	1200
Mobile Cranes	800	1000
Dumpers and Powered Barrows	800	1300
Excavators	1100	1400
Tractors and Shovels	1100	1300
Compressors	1000	1100
Independent Compressor Tools	300	200
Water Pumps	200	500
Rollers (Petrol and Diesel)	1200	1100
Rollers (Steam)	1200	—

TABLE VI

CONTRACTORS' ANNUAL USAGE TIMES (HOURS)

Type of Plant	*Working Time*	*Site Time*
Mixers	600	1500
Mortar Mills	1200	1700
Mobile Cranes	1000	1500
Dumpers and Powered Barrows	1300	1600
Excavators	1400	1800
Tractors and Shovels	1300	1700
Compressors	1100	1600
Independent Compressor Tools	200	700
Water Pumps	500	1100
Rollers (Petrol and Diesel)	1100	1600

Overheads

The overheads were divided into those arising from the operation of the repair shop and those arising from the management of plant. The overheads finally estimated were considered sufficient to cover all costs without any subsidy from other sectors of the firm. To do

TABLE VII

INSURANCE RATES FOR MECHANICAL PLANT

Type of Plant	*Fire, Theft, Extraneous and other Damage; Third Party Road and Site Risks*
Mixers and Mortar Mills	*Rate per cent of the Price when new*
Mixers	1.00
Mortar Mills	1.00
Material Hoisting Plant	
Cranes: Mobile	1.00
Derrick and Rail Mounted (Steam)	1.20
Derrick and Rail Mounted (Other Fuels)	0.85
Hoists, Conveyors, Elevators and Winches	1.00
Material Moving Plant	
Dumpers and Powered Barrows	1.40
Locomotives	1.20
Levelling and Digging Plant	
Excavators (with one attachment)	1.00
Tractors (All types):	1.10
Shovels and Loaders	1.25
Trenchers	0.90
Powered Tools	
Hammers	1.00
Sawbenches	1.00
Compressor Equipment	
Compressors	1.40
Independent Compressor Tools	1.40
Pumps	
Concrete Pumps	1.00
Water Pumps	1.00
Rollers	
Petrol and Diesel	0.40
Steam	1.50

this required, on average, about 40 per cent of the net maintenance costs to cover the overheads of the repair shop, and 10 per cent of the net annual charge to cover the cost of handling and managing the plant pool.

Insurance

The cost of the benefits and services obtained by effecting engineering insurance is included in the maintenance costs and it is therefore unnecessary to make an allowance for it in the form of engineering insurance premiums. On the other hand, an allowance must be made for the risks arising from third party road and site risks, in so far as these arise from the employment of plant and for the risk from fire, theft, extraneous and other damage to the plant itself.

The cost of the cover for these risks can be charged on the basis of the insurance premiums required to cover them, irrespective of whether insurance is, in fact, effected or not. The appropriate rates have been obtained from the industry and for convenience have been expressed in the form of percentages of the cost of plant when new. These percentage rates are given in Table VII.

Normal Third Party Risks and Common Law Workman's Compensation are usually covered by general policies effected for the contract as a whole and these usually cover the use of the normal types of small plant. The premiums for these risks in respect of the plant department staff have been included in the overheads.

The Annual Costs

The annual costs to be covered are the costs of replacement, interest, maintenance, licences and insurance, and administration, that is, the total costs of owning and managing the plant pool. These various costs have been built up earlier in the paper in terms of percentages of the price of the machines when new and the total annual costs can now be estimated from them. For example, the annual cost for a mobile diesel crane is 23 per cent of its purchase price when new, made up as:

Replacement cost when rate of interest is 5 per cent (from Table III)	3·45
Interest on loan at 5 per cent	5.00
Net maintenance cost (from Table II)	8.00
Maintenance overheads (40 per cent of net maintenance cost)	3.20
Licence and insurance (from Table VII)	1.00
	20.65
Administrative overheads (10 per cent)	2.07
	22.72

say 23 per cent

The estimated annual costs, built up in this way for the various items of plant are given in Table VIII. In order to make the table of estimates more comprehensive, figures have been included, on the basis of analogy with other types, in one or two cases for which basic data were not available.

Any contingency allowance thought necessary can readily be added to these figures. It might be thought advisable, for instance,

to add an allowance to cover exceptionally bad experience in operating the fleet. Some managements favour this practice as they consider that expenditure frequently exceeding revenue has a detrimental effect on the general running of the plant department.

The various factors entering into the annual costs have, of necessity, been estimated on the basis of the costs of plant working at

TABLE VIII

ANNUAL COSTS AS A PERCENTAGE OF CURRENT NEW PRICE*

Type of Plant	*Petrol*	*Diesel*	*Electric*	*Steam*
Mixers and Mortar Mills				
Mixers: Local Authorities	22	20	20	—
Contractors	31	30	28	—
Mortar Mills	38	35	33	—
Material Hoisting Plant				
Cranes: Mobile	26	23	—	—
Derrick	—	—	14	14
Rail Mounted (including Tower type)	—	—	14	14
Hoists, Conveyors, Elevators and Winches	23	22	20	—
Material Moving Plant				
Dumpers and Powered Barrows:				
Local Authorities	20	17	—	—
Contractors	32	29	—	—
Levelling and Digging Plant				
Excavators	—	24	—	—
Tractors: Local Authorities	26	24	—	—
Contractors	37	35	—	—
Shovels and Loaders:				
Local Authorities	28	26	—	—
Contractors	39	37	—	—
Trenchers	28	26	—	—
Powered Tools				
Hammers	—	—	36	—
Sawbenches	28	—	17	—
Hand Saws	—	—	36	—
Compressor Equipment				
Compressors	27	23	20	—
Independent Compressor Tools	22	—	—	—
Pumps				
Concrete Pumps	—	25	25	—
Water Pumps: Local Authorities	21	—	—	—
Contractors	38	38	37	—
Rollers	19	18	—	15

* Assuming interest at 5 per cent. The figures do not include cost of day-to-day maintenance, haulage, operatives, or consumable stores.

current average rates although these usage rates were substantially higher for some types of plant than others. No evidence is available as to how costs vary with changes in usage rates. The concensus of opinion of the engineers interviewed was that plant deteriorated as much or more when not in use as when working. It is probably reasonable to assume that the figures given are applicable over the

range of usage which is of practical importance. They would probably not apply to plant used only very rarely, or plant used for exceptional periods, as for example on double shift-working.

It did not appear from the data that the maintenance costs varied very much from one undertaking to another except in the few cases where very special conditions obtained. Nevertheless, it is likely that the machines will be subject to greater wear in some cases than in others and it is unlikely that the average maintenance costs are applicable to plant working largely, for instance, on open-cast coal extraction, or in gravel or sand pits or in quarries.

FUTURE APPLICATION

The figures given above of annual costs are, of course, based on past experience and it is necessary to consider how far these figures can be used as a measure of future costs. The main changes likely to cause plant costs to differ from those given above are: changes in price levels; changes in the ages up to which it is considered worthwhile to keep plant; and obsolescence.

Changes in the levels of prices do not create any particular difficulty. The annual costs have been estimated as percentages of the prices when new and so can be applied equally readily to any set of prices. It is reasonable to assume that the costs of maintenance move roughly in step with the costs of new plant. The application of the annual costs percentages given in Table VIII to current prices of new plant will automatically adjust for both rising machine prices and maintenance costs, thus ensuring that the purchasing power available for both maintenance and replacement is always sufficient at the current level of prices. The reserve will, in effect, partly offset the capital borrowed to finance the purchase of the plant and no special adjustments for interest and capital depreciation in the reserve are necessary.

As explained earlier, the age to which plant is kept is in some measure artificial since its life can be extended more or less indefinitely. There is some belief that the periods over which plant is kept would be far less than the figures indicate were plant freely available. In fact, there appears to be little evidence that there is any large unsatisfied demand for plant. Lengthy waiting lists and long delivery dates may only be the result of attempts to anticipate plant requirements by early ordering, a habit engendered by war and postwar shortages. An examination of the figures of output for the home market suggests that the supply of machines over the last five years has been sufficient to allow undertakings to replace the older parts of their fleets. For example, the number of new excavators coming on

the home market over the last five years amounted to over 50 per cent of the total stock in 1950, for large dumpers it was over 40 per cent, over 50 per cent for mixers and about 30 per cent for tractors. At the same time, figures obtained in the survey do not indicate a very intensive usage of the plant. An examination of the age distributions of the fleets observed shows that the old plant only represented a few per cent of the plant purchased new during the period of observation. It is therefore doubtful whether a large increase in the supply of new plant to the home market would be followed by a wholesale clearance of the older plant, and by a change to a policy of scrapping plant at the end of the periods that are often advocated for depreciation purposes. And there is some doubt whether a policy of scrapping plant after a few years of life would be economic. The replacement factor[4] for plant with a twenty-year life is 2.8 per cent, for fifteen years 4.4 per cent, for ten years 7.6 per cent, and for five years 17.2 per cent. The maintenance data suggest that the maintenance costs would not fall sufficiently to offset the rise in replacement costs, although this does not mean that the ages to which plant were observed to be kept were the optimum ones. The new Investment Allowance introduced in April 1954 does, of course, give some added incentive to a more rapid turnover of plant but for most contractors[5] the incentive is only marginal. For tax purposes money spent on repairs is treated differently from money spent on purchasing plant but at current levels of taxation and allowances the result is not very different, unless the depreciation allowances are much above or below about 12.5 per cent. Most contractors' plant is depreciated for tax purposes at rates varying from 10 to 20 per cent per annum. Where tax is paid at the standard rate there is, for example, a saving in favour of money spent on purchasing plant rather than repairing old plant of about 2 per cent, in the case of plant with a basic allowance of 15 per cent.

Obsolescence can arise in a number of ways; new plant more efficient or cheaper than existing plant may be placed on the market, changes in safety regulations may entail relatively costly alterations to existing plant, or changes in building technique or in types of building may render existing plant less useful. The effect in each case is to raise the costs of operating existing plant relatively to those of new plant, and thus to prevent the plant owner from obtaining a full return from the money invested in existing plant. In the past, and under present conditions, obsolescence appears to be of little importance; any obsolescence that occurred over the period surveyed,

[4] Assuming 5 per cent interest.
[5] Local authorities are not affected by tax changes.

1950-53, is, of course, reflected in the costs given and there would appear to be no reason to expect any considerable increase in the amount of obsolescence in the future. Any obsolescence anticipated can be covered by the addition of a contingency allowance, but it would not appear that this need be very substantial. For instance, a contingency allowance of about 1.5 per cent would cover the loss that would result if a new type of mixer, with operating costs 4 per cent less than those of mixers bought at the present time, came into general use in five years time.

BUILDING RESEARCH STATION, LONDON

Acknowledgements

Thanks are due to the many contractors, local authorities, and others, without whose willing co-operation it would not have been possible to carry out this investigation.

The work with which the report deals forms part of the programme of research of the Building Research Board, and the paper appears by permission of the Director of Building Research.

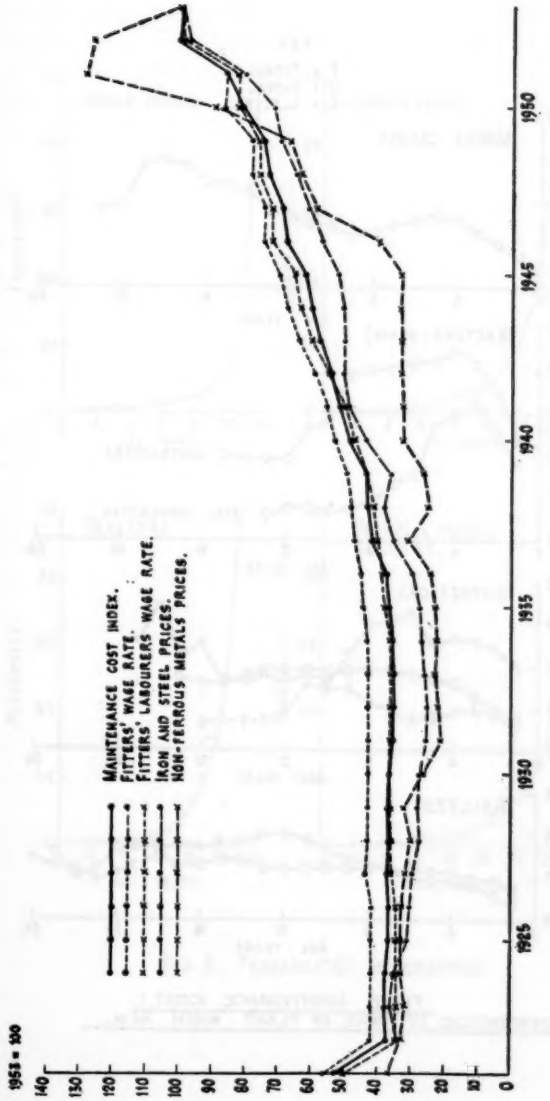


FIG. 1. MECHANICAL PLANT MAINTENANCE COST INDEX

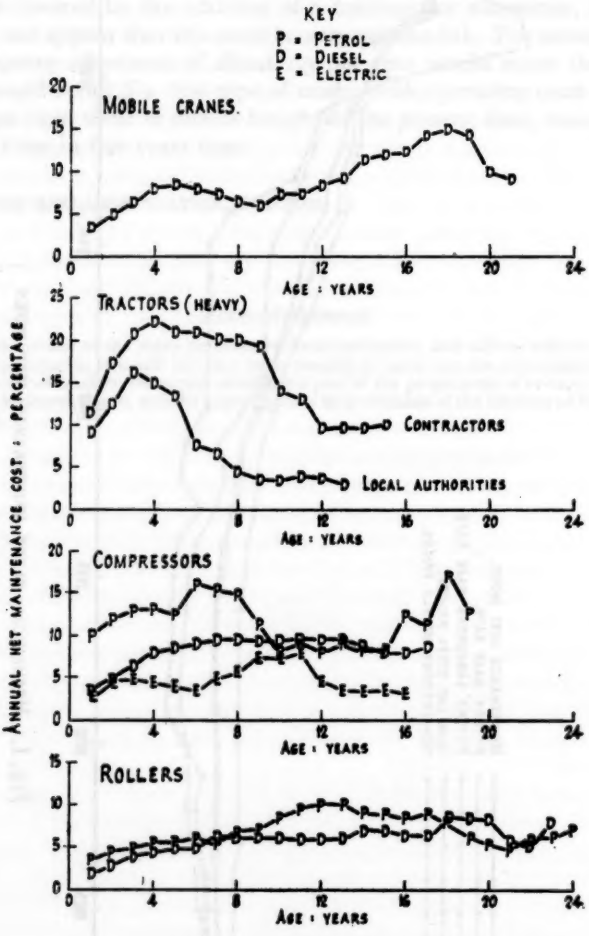


FIG. 2. MAINTENANCE COST: PERCENTAGES OF PRICE OF PLANT WHEN NEW.

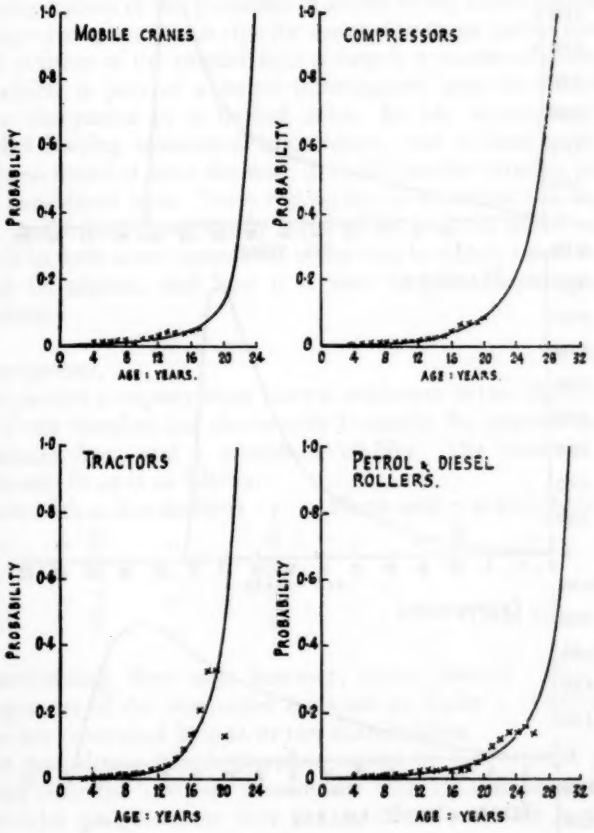


FIG 3 PROBABILITIES OF SCRAPPING

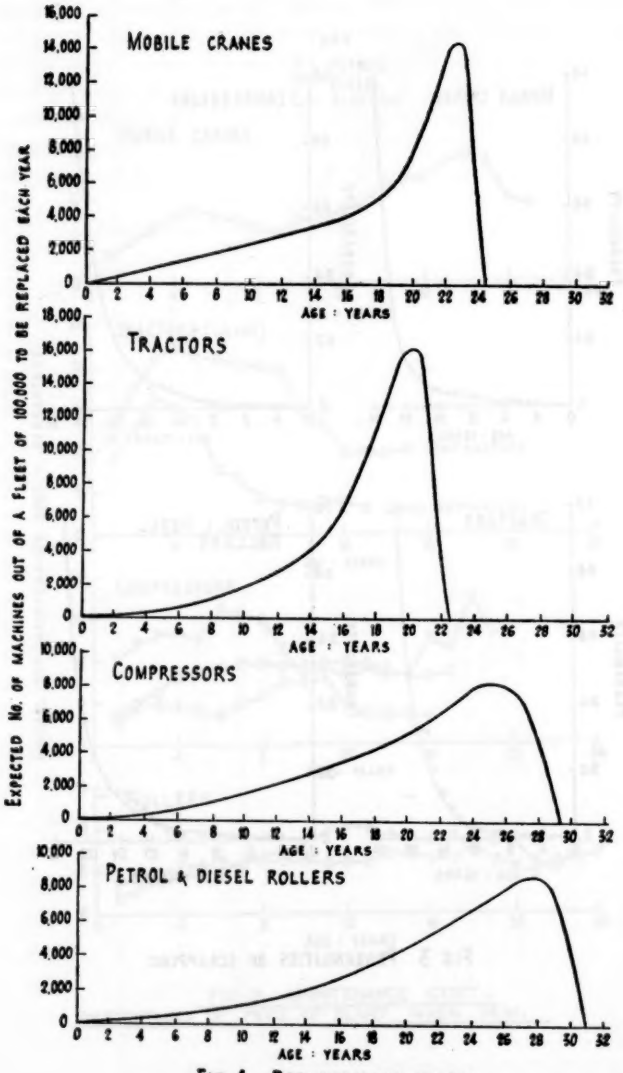

MOBILE CRANES
TRACTORS
COMPRESSORS
PETROL & DIESEL ROLLERS
EXPECTED No. OF MACHINES OUT OF A FLEET OF 100,000 TO BE REPLACED EACH YEAR
AGE : YEARS

FIG. 4. REPLACEMENT RATES

THE SUPPLY OF CAPITAL TO NEW BUSINESSES[1]

by F. R. Jervis

One of the largest gaps in our knowledge of actual economic conditions is in the field of private company finance. While more is becoming known of the problems of access to the capital market for the larger company that is ripe for conversion to the public form, the actual position of the smaller firm is largely a matter of guesswork. This article is part of a larger investigation into the finances of private companies in a limited area. In all, seventy-two firms provided varying amounts of information, and of these twenty-one have been founded since the war. It is this smaller number which is being considered here. From the replies to questions put at interviews, and from figures kindly supplied by some of the firms, it is possible to form some conception of the way in which a new business obtains its capital, and how it is able to grow, under post-war conditions.

The entrepreneur.

The private company must have a minimum of two shareholders, even if one member has shares only to satisfy the provisions of the Companies Acts, and a maximum of fifty. The number in the twenty-one firms is as follows.

Firms with 2 shareholders	7	Firms with 7 shareholders	1
" " 3 "	4	" " 8 "	1
" " 4 "	3	" " 11 "	1
" " 5 "	2		—
" " 6 "	2	Total Firms	21
			—

Shareholding does not, however, mean control. The actual management of the companies is shown in Table 1. Fifteen companies are controlled by one to two shareholders.

The typical new firm is therefore owned by two to three people, in many cases the 'two' are the founder with his wife being made a shareholder and director; they are in effect 'one man businesses' which have taken advantage of the Acts to become incorporated. The other interests are small.

Of the fifteen firms with two major shareholders, one has two people who have contributed one third each of the capital, plus nine

[1] This article is part of a larger survey conducted into the post-war financial conditions of a sample of private companies, for the purposes of research for a Ph.D. thesis. A general article, covering different aspects of the same theme, has been published in the March 1955 issue of *The Director*.

people who have put in very small amounts. They are friends or business associates who can afford to wait for a return on their investment. One is run by two brothers, and three members of the family provided small sums to help the start of the firm, and two other people contributed a small sum each. One was started by two

TABLE I

SHAREHOLDING, MANAGEMENT AND ORIGINAL CAPITAL

Company	*No. of shareholders*	*No. in active management*	*Original capital* £	*Capital provided by*
1	5	5	3,000	Founder. Other shareholders are sons.
2	11	2	6,000	2 main shareholders. 9 business associates, smaller sums.
3	2	2	1,200	Founder. Wife other director.
4	4	2	400	2 founders plus loan of £400.
5	3	3	10,000	2 founders, then a third member.
6	2	2	500	Founder
7	7	2	800	Founder, plus family savings.
8	2	2	500	Mortgage on house, plus some old machinery.
9	6	5	700	All shareholders equally, plus loan of £3,000 (since repaid from profits).
10	6	2	10,000	2 founders, plus trade connections.
11	3	3	5,000	3 founders equally.
12	2	2	2,000	2 founders equally.
13	3	3	1,000	3 founders equally, plus loan from one director.
14	4	2	5,000	Founder and wife, plus 2 business contacts.
15	4	2	1,000	Founder and wife, plus 2 employee shareholders.
16	2	2	not known	Founders equally.
17	8	8	18,000	Equally. Shareholders have other interests.
18	5	2	2,500	Founder, plus members of family.
19	2	2	not known	Founder and wife.
20	2	2	250	Founder, plus £200 loan from relatives.
21	3	2	1,500	2 founders, plus small amount from trade connection.

people with experience in the same business and four other people helped with the capital but take no active share in the management. One has three outsiders with a small stake only. The three firms with four shareholders are all 'husband and wife' firms, in one case the two outsiders have contributed a small amount of capital, in one they are business contacts, and in the other senior employees who have been given an interest in the business. The remainder are either man and wife or two business associates.

Three firms are controlled by three people each, in two cases all work in the business and in the other one of the owners is actively engaged in a similar business. In the larger directorates, one firm is

owned by a father and his four sons; he founded the business and later he was joined by his sons who had been trained in that particular trade. One has six owners, one of which provided a loan at the beginning, the others all work in the firm. The largest, with eight owners with an equal share, seems a peculiar case. But they all have other interests and a part-time share in developing this new company.

The original capital.

The twenty-one firms comprise nine in various branches of the engineering and metal trades, four in textiles, hosiery, weaving, etc., and eight in a variety of trades, manufacturing and merchanting. (No retail firms were approached.) Table I shows the position as far as the original capital is concerned, and is summarized as follows:

under £1,000	8 firms
£1,001 to £2,000	3 ,,
£2,001 to £3,000	2 ,,
£3,001 to £5,000	2 ,,
over £5,000	4 ,,
not disclosed	2 ,,
	21

Five of the firms started with less than £1,000 were engineers. At the end of the war there were good opportunities for people with the necessary skill to buy cheap machines that could be repaired if necessary and be sufficient to employ one man. In each case the firms were started by people with considerable machine experience so that they would know what they were buying. With rented premises, a few lathes and good workmanship, contract work can be undertaken for larger firms. With the post-war demand conditions there has been no shortage of work put out. Some have developed lines of their own or are acting as main contractors to non-engineering industries. In some branches of the textile trade it is possible to start in a similar way; some of the machinery can be bought in small units, sufficient to employ one worker, and extensions can take place gradually. In others, such as fully fashioned hosiery the unit of machinery is large and expensive. Unless the founders have acquired considerable savings some reliance on outside sources is inevitable. But there 'outsiders' are largely close friends or business associates.

While in many cases the founders have attracted other shareholders who have provided part of the capital without taking an

active share in the business there is a strong objection to assistance from 'the financier'. If an outsider comes in on equity terms there is the danger that the founder will lose control. Moreover the interests may not be the same. The founders are usually drawn from people with practical experience who are interested in building up a business and take the long term view. The financier is more likely to be concerned with a quicker return, and if he is subject to a high level of taxation, he is looking for a tax free capital profit. Instead of welcoming outside financial assistance in the more difficult early days, entrepreneurs have had more offers of capital than they have been prepared to use. In several cases after a firm has been successfully established people have come along with offers of capital and these have been refused. One firm which did accept capital from a professional man had to buy him out later at eight pounds for each one pound share to regain control. 'It was expensive, but it was worth it.' Non-controlling shareholders are usually relatives or business associates or connections. Unfortunately, the terms on which shares are taken up are not known.

Bank advances.

Rather than admitting outsiders entrepreneurs prefer to borrow from the banks. The point of interest here is to what extent the banking services of the country are available for *new* firms that have often insufficient capital and no record of successful history to offer. Thirteen firms out of the twenty-one have made use of bank advances, seven have never borrowed and one has borrowed once for a special purpose (a temporary increase in stocks). There is general satisfaction with the system. As one managing director stated: 'The bank manager has a knowledge of the past record of the firm and of the amount of profit drawn out by the owners. He can see to what extent they are putting their own capital and faith into the business and so can make a good assessment of the risk involved. Where the bank manager has confidence in the owners bank loans can be a cheap and flexible method of financing.'

Sometimes the credit is obtained against the deposit of securities, or against the personal guarantee of one of the directors, but this is by no means always the case. In spite of criticisms directed against modern banking organization and the substitution of the bank manager for the independent banker of former times, new firms have found that there is the personal contact and real interest taken in their businesses. Advances have been obtained, often for considerable sums in relation to the paid up capital, on face value alone. One obtained new premises through the interest of the local manager

who knew that the firm's existing lease was expiring. Another discusses and advises when new machinery is to be installed, even if no bank finance is being used. As to rule of thumb methods — 'Some bank managers are more cautious than others and the business man can play one off against the other and get any reasonable request', said one owner who had changed his bankers.

In one case only did it appear that the firm wanted bank assistance and was unable to get it, but as a similar antagonistic attitude was taken by the founder over other sources of finance, the firm may not have been considered a good risk. The fact that seven other firms made no use of bank advances does not mean that they were refused by the banks. In three cases the founders on principle objected to borrowing. They would not risk other people's money without the latter having the opportunity of sharing in the profits. Perhaps a surprising attitude; but it shows the independent spirit behind the founders of businesses. But the main reason why bank credit has not been used is because the firms have been able to do without it.

Hire-purchase and creditors.

Ten firms only out of the total sample of seventy-two used hire-purchase for the supply of their machinery. Of these eight were founded in the post-war period. The old established firm replaces its machinery at intervals, out of depreciation provisions and reserves, but the new firm must start with all its machinery at once. (Apart from any increase in size of the firm, and that will apply equally to firms of all ages.) Hence its machinery requirements are much greater than with an older firm, especially in relation to its capital. And while hire-purchase finance does not play a prominent part in normal business finance that part is important. It may help the new business to get started. Without the start it cannot grow. Although the rates of interest charged are above those for a bank loan the latter may not be appropriate in the circumstances and the firms using hire-purchase are quite satisfied with the arrangement. The earnings on the new machines are sufficient to pay for the charges, and sometimes to pay off the capital sum before the due date. The extra interest is no burden — it is a taxable expense. Once the firms have been established for a number of years they can generally dispense with hire-purchase, while recognizing the value of it under different circumstances.

On the whole, credit terms seem to vary more with the type of trade than with the age of the firm so that the new firm will have to conform with the normal methods of payment in settling its accounts, and rely on the same customs in getting in its own payments from

debtors. In the majority of cases we may say that credit is 'neutral' in the sense that the same credit is obtained from suppliers, say monthly terms, as it granted to customers, so that the firm is not financing itself from its suppliers. Where creditors exceed the debtors the excess remains within the firm and can be used to finance machinery and stocks so that part of the capital requirements is being obtained from outsiders.

With small engineering firms the system of monthly accounts is normal but some variations have been noted. One firm starting on a limited capital usually settles its accounts monthly but at times suppliers have allowed the account to run for three months. One supplier of a component at a time when his own trade was slack provided goods on open credit and the amount was paid off as and when the money became available. The reason was that the supplier preferred to give this credit rather then reduce his staff and face the difficulty of replacing it when trade recovered. Another firm which pays its ordinary accounts monthly extended its premises on credit terms and another stated that in the early days considerable help was obtained from creditors who allowed the acccount to run for three to twelve months. Where large suppliers are interested in building up a trade connection they will often allow more than the normal credit to a new firm. After this has become established the long terms are no longer necessary and the accounts are settled more promptly. Most of the firms in this group seem to be sufficiently strong financially to be able to settle their accounts within the month. In some cases the nature of the work means that this is not a difficult task. The firm that is doing contracting work on customers' own materials, e.g. machining castings that have been supplied by the main firm, is put to little expense for stock. Its main expenses are the running expenses of the machinery and the labour cost of the work in progress. Generally the payment for the work done is monthly in arrears. If anything, the larger firm tends to be the slower payer. One firm generally gets its money in monthly but the large firms were often three months in arrears. 'When the large firms are busy they put out plenty of work, but they are slow in paying for it.' When one owner was asked what credit he gave he replied that some customers *take* credit according to their own ideas. Larger firms get tied up in routine and when they install a new accounting system it always means that the times of payment become longer. Government departments are very difficult.

The experience of textile firms dealing through wholesalers varies greatly. Some wholesalers take a long time, and then deduct cash discount from the remittance, others pay immediately by bank

transfers. One firm had to refuse business to a large wholesaler because the payments came in so slowly. Government departments take from three to six months and 'an allowance is always made for this locking up of working capital when submitting tenders. The taxpayer has to finance the extra interest'.

Considerable light is thrown on methods of payment by a post-war merchanting firm that trades with many different types of customers. Accounts are rendered at the end of the month and are due for payment within the month. Some of the customers are slow payers. 'The moderate sized old established business pays on the nail. The newer small firm pays well in the early stages and then takes longer credit. With the larger old established firm there often appears to be accounting difficulties within the organization, some pay very slowly, but others pay before the time.' The accounting ritual bears no relationship to the period of credit.

Ploughed back profits.

Expansion by the ploughing back of profits has always been the traditional method of building up a business. For a firm to expand its capital out of profits it is necessary for it to carry out a successful trade. Post-war demand conditions have been favourable to the creation of profits as turnover has been maintained without the set-backs of industrial recession to eat into profit figures. It is also necessary that the entrepreneurs are willing to leave the profits in the business. One should expect that the founders of new firms will start with some enthusiasm for their work and this will carry them on to expand their undertaking by a natural growth into something larger. Apart from the purely financial reward that will follow from a growth in the profits with an increase in size, there is the less tangible, but none the less important, feeling of achievement in having built a business, and this sense of achievement may willlingly be purchased at the cost of present consumption. This sense of purpose has been found to be very strong in the sample of firms investigated.

Of these twenty-one firms (all started since the war), sixteen of them have expanded out of profits; the remaining five have not been established long enough to have accumulated reserves, but they regard future profits as their hope for survival or future expansion.

A small family business in the engineering trade which started to manufacture its own product with a modest capital has grown considerably and extended its markets. 'All expansion has come from profits. The members of the family working in the business are paid the same wage they would earn in their own trade and the

remainder of the income is left in the firm. Their standard of living is no higher than that of their skilled workmen.'

Another firm with even less capital at the start has since the war increased its capital from £1200 to over £5000 by building up reserves. The full profit each year is charged to the managing director's salary on which the normal earned income tax relief is given. Against this moderate drawings are made so that the balance accumulates as a loan from the owner of the business to the company. The money has been used to purchase new machinery and to extend the premises. Another that had considerable difficulty at the start in getting together adequate capital soon repaid its loans and built up its capital out of profits. 'In the second year we could not help making a profit.' Long hours of work were put in on profitable contracts. For the first three years the managing director drew a nominal wage only. The other shareholder directors who had put in some of the capital (and had other sources of income) were prepared to wait for a return on their investment. Their share of the profit was left in as an interest free loan. A strong position has been built up with considerable cash balances.

In six years, in spite of early shortages of capital, a small firm built up its capital from £500 to £3000, most of it coming in the last two years. Another increased its capital from £800 to over £9000 out of profits. It is reaching the size where it has to pay income tax on the company's profits after the directors' remuneration has been paid. Even where part of the original finance has come from hire-purchase, the source of the repayment of the advance has been profits. In one case it meant a hard struggle and often the operatives took home more money than the owner each week. But that stage is now over.

One firm that started with £700 plus a large loan from one of the directors was able to pay off this loan and increase its issued capital to £15,000 out of profits in a few years. All the owners work in the business and all leave in a large proportion of their profits. 'There have been no extravagant drawings and all the directors are content to use small-horse-powered cars.'

Up to a point, with the director-controlled company, taxation as such does not fall on the company so that reserves can accumulate if the directors are willing to build by limiting their drawings. 'Taxation will not prevent expansion and is not regarded as a burden as long as the firm is expanding' was the comment from one successful founder of a new business. The tax on profits takes fifteen months to get in and as long as business is expanding last year's tax can be paid out of this year's increase in profits. New machinery has been

installed out of income and initial allowances and depreciation charges have reduced the tax burden in the early years. But if the firm made a loss in any year there would not be the cash resources to meet last year's tax. 'Tax is paid in arrears and although a damn nuisance it does not stop expansion.' The time lag in the payment of tax provides the company with working capital — it amounts to an interest free loan from the Treasury for one to two years. This 'loan' becomes a permanent feature of the balance sheet and the current liability increases each year as the profit increases. 'Taxation will not stop the enthusiastic man. In the first year it is necessary to work seven days a week for poor returns. In the second year trade increases but the owner still draws less than a foreman and leaves the rest to accumulate. Then a demand note for practically all the profit reserve absorbs the money that was going to be spent on extensions. But the enthusiasm is not yet killed and in the third year the profit is doubled. In the next year comes a demand for about half of this. And so on.' But by this time the firm has become reasonably well established, and the capital *has* come out of profits, even if the incentive to expand further is lacking. (However, there may be other reasons for the slowing down of the rate of expansion and taxation may be given as the excuse. These are not examined here as the sole point of this section is to prove that profits are still serving their traditional role in the provision of additional capital for new firms.)

TABLE II

EXPANSION OF CAPITAL FROM PROFITS

8 FIRMS ONLY

Original capital	*Present capital and reserves*	*Increase in capital*
£	£	£
6,000	12,000	6,000
1,200	5,700	4,500
400*	4,700	4,300
500	3,000	2,500
800	9,500	8,700
700*	65,000	64,300
5,000	19,000	14,000
5,000	28,000	23,000
19,600	146,900	127,300
Average 2,450	18,362	15,912

*Supplemented by loans, which have since been repaid.

Summary.

Of the twenty-two firms, fifteen have used profits as the main source of expansion. In eight cases bank advances have provided a secondary source of additional capital, and in four, creditors

hire purchase have at times been important. As a third line of defence, bank advances have been used in one firm and creditors and hire purchase in five firms. Three firms only have had any substantial amounts of new capital put in (substantial in relation to the original capital.) In each of these three cases the firm was started experimentally, and when it seemed to have made a good start other members of the families assisted the founders. In three others small sums only have been put in. One firm has made a small expansion only, and three of them have not been established long enough to have accumulated reserves.

TABLE III

SOURCES OF ADDITIONAL CAPITAL

	Profits	*Bank*	*Creditors*	*New capital*	*Total*
Main	15	1	—	3	19
Secondary	1	8	4	2	15
Tertiary	—	1	5	1	7
Totals	16	10	9	6	41

In a number of cases it has been possible to obtain balance sheet figures. The following table shows the net increases in assets of four firms in six years and the sources of this increase.

TABLE IV

INCREASE IN ASSETS AND SOURCE OF FINANCE

	£'000		£'000
Land and buildings	17.3	This has been financed by	
Machinery and plant	11.7	Increase in capital and reserves	99.6
Stocks	38.7	Increase in creditors including tax provisions	19.1
Debtors	25.7		
Cash	39.9	Increase in bank advances	14.6
Total increase in assets	133.3		133.3

Balance sheets of similar firms although not strictly comparable, show a similar result. The increase in creditors is more than offset by the increase in debtors so that these firms are not getting indebted to the rest of the economy, and the increase in bank advances is offset by the greater increase in cash holdings. Profits ploughed back have been sufficient to increase the real assets and to leave something over to place the firms in a more liquid position in the event of a decline in the profits.

DERBY TECHNICAL COLLEGE

HIGHWAY FINANCE*

by GILBERT WALKER

I

'THE story of the modern road', says Rees Jeffreys in his autobiographical account, 'really begins with the Local Government Act of 1888, setting up the County Councils.' (1) The councils of the new administrative counties were constituted in 1888 as the highway authority for the main roads. By 1900 the last of the surviving 'highway parishes' had been absorbed in the new jurisdictions. 'Locomotives' passing along the road were released in 1896 from the provisions of the Acts of 1862 and 1882, requiring them to travel at no more than 4 miles an hour and to be preceded by a man carrying a red flag. Motors were registered in 1903, numbered fore and aft and they and their drivers were licensed. The principal cycling and motoring organizations, combined for once upon a common platform, launched in 1901, the Roads Improvement Association. A departmental committee was formed two years later to examine the administration of highways. Nothing came of it nor was anything then done to reorganize the responsibility for highways. That remained where it always had been, on the local authority. The Select Committee on Estimates, inquiring fifty years later in 1952, put at 1285 the number of separate highway authorities and this was a reduction, caused by the elimination of the rural district councils, from the 1800 or 1900 before the Great War. (2)

The Honorary Secretary of the Roads Improvement Association (Mr. Rees Jeffreys) ably assisted by others, continued his vigorous propaganda for better roads after his induction into office in 1901. A Development and Road Improvement Funds Act was passed by the Liberal Government in 1909 and Mr. David Lloyd George, then the Chancellor, made the first general provision† for highway improvement from central revenue in his budget of 1909. Motor vehicles were subjected to duty on a scale rising from £2 2s. 0d. for vehicles of 6½ h.p. or less to £10 10s. for vehicles of 33 to 40 h.p., £21 for 40 to 60 h.p. and £42 for vehicles exceeding 60 h.p. Tax on motor spirit was levied at 3d. a gallon and at half that rate when consumed by commercial vehicles. None of these motor taxes were taken for the general credit of the Exchequer. The net proceeds issued from the Consolidated Fund as road improvement grants,

* The *numbered* references have been collected and are appended at the end of this article, p. 178.

† Government had earlier contributed to specific highways required for strategic purposes, i.e. roads in the Highlands after the '45.

to be administered and applied (but not for ordinary maintenance and repair) subject to regulation by the Treasury by a Roads Board constituted under the Development and Road Improvement Fund Act of 1909. (3)

£23 million in all had been raised between 1909 and 1920 in licence duty and petrol tax. War intervened after 1914 and payments into the Fund were suspended from 1916 to 1919. £16 million were received by the Fund, £13 million were committed and £7 million actually spent. Treasury regulation might have been an obstacle had the Board wanted to pledge their future expectation of revenue for some large piece of road improvement. Apparently they did not. They were content to spend current revenue on current improvements. £11 million out of £13 million went on the surface of the existing roads. The dust was laid by putting down tar and the wasted chances have since been the theme of Mr. Rees Jeffreys in his autobiography.

The Board were dissolved in 1919 and the Fund wound up in 1920. Oversight and support, both financial and technical, of the administration of highways now went to the newly formed Ministry of Transport. The Finance Act of 1920, Section 13, levied heavier duties on motor vehicles. Private cars were assessed on horse power, measured by cylinder bore (the Treasury rating). Commercial vehicles were taxed on the unladen weight of lorries and on the seating capacity of buses. Petrol was freed from duty. Responsibility for collecting the new taxes was taken from the Commissioners of Customs and Excise and given to county and county borough councils, where it still remains. The proceeds of tax were paid into the Exchequer and issued, less certain small amounts representing the assumed produce of the carriage licences, into a Road Fund, constituted by the Roads Act 1920. Moneys standing to the credit of the Road Fund, after meeting the costs of collection and certain other administrative expenses, were to 'be applied by the Minister for the purposes of Part II of the Development and Road Improvements Funds Act, 1909, as amended by this Act'. (4) Those purposes briefly had been to improve the facilities for road traffic in the United Kingdom by the construction of new roads and the improvement of existing roads, either directly or by contributions to the revenues of local authorities. (5)

The income of the Fund and the revenue from motor registration duty grew and grew fast. Grants fell consistently short of income and a balance accumulated. The temptation for Chancellors hard-pressed and lacking the financial rectitude subsequently displayed by Lord (then Mr. Philip) Snowden in 1931 (6) was too great. A

proportion — one-third — of the registration duty payable by the owners of private cars was taken into the Exchequer in 1927 and a part of the surplus was appropriated in 1927 and again in 1928. 4d. a gallon was laid on petrol in 1928, later raised to 6d. and then to 8d. in 1931. The Road Fund found £6½ million towards the block grant paid to local authorities under Mr. Neville Chamberlain's Local Government Act of 1928 and it was raided again in 1936 and 1937. The Road Fund as such was wound up in 1936. The proceeds of motor taxation have since been paid directly into the Exchequer and the Road Fund has existed in name only, as the title of the account to which the Treasury has credited grants in aid of highway upkeep and from which payments were made to the local highway authorities. The Road Fund was finally dissolved in 1954 and has now disappeared even as a name.

Registration duties on the heavier commercial vehicles were increased by the Finance Act of 1933. The tax on private cars, 20s. a horse power in 1920 raised to 25s. in 1938, was replaced in 1947 by a flat rate of duty — at first £10 and laid only on new cars. Duty was raised in 1951 to £12 10s. and extended to all cars new and old. Tax on petrol was put up from 9d. to 18d. in 1950, to 22½d. in 1951 and to the present figure of 2s. 6d. a gallon in 1952. Purchase tax, payable since the war on private cars was levied on commercial chassis in the budget of 1950 and now there is the transport levy imposed on road goods vehicles as an offset to the loss which might arise from the sale of the British Road Services under the Transport Act of 1953. For over a decade from 1920, more was being spent on the highway than the taxes then being raised from the motor user. Revenue had caught up by 1933 and the sum raised in tax is now four times the amount currently laid out on the roads by Ministry of Transport and highway authorities combined. The Road Fund was not' of course, 'fed by (motor) taxation in the strict sense'. (7) But motorists, or at least, their organizations, have certainly assumed that it was and their refusal to accept any compromise with the undertaking given in 1909 and apparently repeated in 1920, to spend on the roads the whole amount raised in motor taxes, has confused the discussion ever since.

A classification of main roads in two classes for purposes of grant, begun by the Road Board in 1914, was completed by the Minister of Transport in 1921. These are the Class I and Class II roads, familarly designated as 'A' and 'B' on the maps and signposts. The Minister was later constituted (by the Act of 1936) the highway authority for 'certain main arteries of exceptional importance to the nation, known as trunk roads'. (8) There are in all, about 186,000

miles of road. The mileage of trunk roads (marked on the 1-in. Ordnance Map, Seventh Series, by a capital T in brackets following the A number) originally 4500 miles, was brought up in 1946 to 8270 miles. The Minister at the same time, in the exercise of his statutory authority, increased the classes of highway on which grant is payable from two to three and raised the mileage from 44,300 miles to 94,200. The Ministry are wholly liable for the trunk roads. They do not themselves do the actual work but employ, as agents, the local highway authorities. Grant towards the remainder of the classified roads is paid at the rate of 75 per cent of the expenditure upon Class I roads, 60 per cent of expenditure on Class II and 50 per cent on the Class III roads. 91,300 miles, about half of the total, remain unclassified and do not rank for grant. 1285 local highway authorities in all are responsible for 177,300 miles of road to which the Exchequer contributes in respect of 86,000 miles.

The highway authority for classified roads within the boundaries of the administrative counties and for unclassified roads in the area of rural district councils is the County Council; and the county borough councils (in London, the Metropolitan borough councils) for all roads within their respective areas. County Councils do, and other authorities do not, receive grant under statute towards the cost of maintenance and minor improvement of roads in their jurisdictions. (9)

In preparing schemes of expenditure, local authorities submit proposals to officers of the Ministry of Transport, the divisional road engineers. These schemes are combined with the engineers' own estimates and forwarded to the Ministry as the requirements for the division. After discussion at the Ministry and between Ministry and Treasury (and in the light of any limits on 'investment' which may have been reached by the Investment Programmes Committee) the divisional engineers are told what may be spent in their division over the year. This is the sum they have to share out between the several claimant authorities. (10) Pressed by the Select Committee to say how views were formed of the correct figures for expenditure on highways, the Treasury could only argue that too much was not being spent if the grants were kept down to something like 60 to 70 per cent of the pre-war totals. At this rate, the current expenditure on highways since the war measured in real terms cannot have exceeded 30 to 40 million 1938 pounds, about one-half of the sum being spent immediately before the war. (11) The expanded road programme, announced to the expectant House of Commons (12) in February 1955, was likely, according to the Minister to 'represent an ultimate expenditure from the Exchequer' of £147 million, spread

over the next four years. This excluded expenditure on certain 'very large projects of national importance' such as the first section of the London to Yorkshire motor road and the 'substantial complementary expenditure of local highway authorities on classified road schemes'. No figures, other than the sum, were given for the particular projects included in the programme for 1955-56. The schemes for trunk roads included those costing over £100,000 apiece; but two only of the schemes for classified roads were put in, each of which would involve a contribution from the Exchequer of £500,000, 'in view of the need for further consultation with local highway authorities'. The value of the schemes in sum was not made clear nor can the programme itself be reduced to an estimate of the annual expenditure over and above the outlay which might be considered the 'normal' annual contribution to maintenance and repair of the highway system.

II

The value of any particular employment of resources to the community at large is to be measured by the *marginal return*, what in fact would be realized from an addition to resources used in this way rather than in that. If the returns to a given investment in A exceed the return to a like investment in B, then A obviously should be chosen if the chooser has it in mind to raise output. Road users, for the purpose of assessing the return to a given expenditure upon highways can be divided into those who can be presumed to keep accounts and those who cannot. The first group comprises the professional hauliers and the coach companies; the second group, besides motor cyclists and the owners of private cars, must also be assumed to include traders carrying their own goods in their own vans — all the 'C' licensees, a majority, in fact, of lorry owners. The returns from a new highway or an improvement include the particular amounts by which the incomes of the first group are raised; and this quantity could, I suppose, be collated from their books of account, given the facilities, the willingness and the ability to carry through so laborious an undertaking. There are 80,000 buses and 130,000 lorries (including the 30,000 or so left to the British Road Services and the British Railways) held on public carriers 'A' licences. The owners of the lorries held on 'C' licences, even supposing their accounts to be kept in proper form, have not always bought these trucks just because that is the cheaper way of carrying their freight. There are, as I have had occasion to remark elsewhere (13), many other reasons besides low cost which lead a trader to buy his own vans. The savings in fuel costs, wear and tear of vehicles and tyres,

and in some cases an allowance for loss of (paid) time to drivers, passengers and cargo might no doubt be measured. But the biggest part of the return to a new road or an improvement to an old one is found in the increased satisfaction and conveniences which the owner of car, motor cycle and truck enjoys from his ownership. That is a quantity which unhappily cannot be set in an account beside an expenditure incurred or to be incurred; and there are $2\frac{3}{4}$ million private cars and 1 million motor cyclists in addition to those 900,000 or so lorries and vans owned by traders.

The device of a toll gets over many of these obstacles. The user places his own valuation on the worth of the highway as at least equal to the toll each time he travels over it. The building and maintaining of motor roads thus becomes a business and can be conducted as such subject, of course, to the safeguards which have to be imposed on any public or private monopoly. Tolls are assessed at whatever figure is expected to yield a return and to recoup the expenditure within such period as may have been fixed upon; and rates of expenditure, both for the construction and the maintenance of the highway can then be governed, not by what Chancellors can afford out of current revenues but by the receipts from tolls, present and foreseen, collected as the price of a service, freely bought and paid for.

The charging of a toll has much historical interest and tolls are being increasingly relied upon in, for example, the United States of America to provide the special facilities needed by the motorist. (14) New motorways to which access is restricted are being financed in this way and so are the many other considerable but expensive improvements such as the bridges and tunnels required to shorten distances or to replace a less efficient but cheaper ferry. But tolls confine the use of the road to those who are willing to pay. All potential users to whom the toll road, bridge or tunnel is worth something but not as much as the toll are deterred by the levy from using it. Should the new road be congested, this limitation on its use serves an excellent purpose. It keeps off the highway drivers who add more to the costs of those who move along it than they are prepared to pay for themselves. The road is thus freed for those to whom the facility is worth at least as much as the toll. But the costs of constructing and maintaining the road are not themselves proportionately enhanced by the addition at any time of more vehicles to the numbers already running over it, and to charge a toll when the road is not fully occupied by the traffic already passing is to cause equipment to stand (relatively) idle which might otherwise be used at less cost by those to whom that use was worth something but

not as much as the toll. (15) This implies some waste at least, of the scarce resources (I speak now of times of full employment) which have gone into the building or improvement of the road and is one thing certainly to be avoided.

Government, the Minister told the House when introducing the expanded road programme, might resort to tolls in suitable cases in order to proceed as rapidly as they would like and as a means of enabling the Exchequer to get something back on the money they had put up. (16) But tolls in Great Britain are not popular if one may judge by the rumpus which can be raised when one of the few remaining toll bridges manages to get itself in the news* and by the postures of defence into which the motoring organizations threw themselves against the very proper proposal in the Road Traffic Bill (1955) to charge by parking meter for the use of the road as a warehouse for cars. (17) Tolls on the projected new roads in Great Britain would in any case be open to the fatal objection that it is the old road which is congested and not the new. The toll, to be of any value at all, should be raised from the week-end motorist who clutters up that rolling road which rambles round the shire and not from the public-spirited driver who makes so proper a use of the fine straight motorway which the engineers have made specially for him! (18)

In a fully employed economy such as Great Britain is now and confidently expects to remain (as long as conscription lasts and defence requirements keep up) productive resources are everywhere fully occupied. The expenditure responsible for full employment consequently is already being laid out. Output is greater, accepting the premise of the argument that resources return more when spent on roads than sunk in other employment; but if outlay in gross is caused to rise by road improvement by more than the increase in output consequent upon the better distribution of resources then those responsible for financial policy have made a mistake. They have allowed money expenditure on roads to be added to the outlays generating (money) income in gross without taking the elementary precaution of reducing expenditure in other sectors by the amount they expect national income to be increased as a result of the expenditure upon highways. This is a pertinent consideration for those responsible for national economic policy; (19) but an economist or anybody else, writing about investment in

* The Cumberland County Council was urged by the citizens of Great Corby to buy out the bridge which lies between them and the railway station. The Toll, of one penny, seems a small sum to pay for the privilege both of reaching the main transport system of the country and of avoiding 'a long journey between the villages' (*Manchester Guardian*, September 9th, 1955).

a particular section of the economy, as for example in transport, has to assume that the larger problems of inflation caused by the pressure of demand have already been resolved, or at least, discounted.

Between the wars and during the depressions of the 'twenties and the 'thirties, it was possible to argue that 'the real cost to the community of an investment in road works was small. Labour is (or was then) the principal cost; and men who would otherwise be idle on relief might just as well be usefully employed on building roads', always supposing, it should perhaps have been added, that the unemployed want to work on the roads, can reasonably be asked to do so, and that roads are being constructed where men are available for work. (20) In 1955, however, there is no labour idle on relief, no resources which are not already occupied. If men, materials and machines are to be put to road-making they must be taken from or attracted out of the (useful) occupations in which they are already engaged. And if the men are imported, from Ireland or Jamaica, let us suppose, and the cement and machinery produced as the output (net) of new factories run up to meet the demand, then the problem is only pushed back. Native Britons employed on the roads would presumably have devoted their energies to something else. Remittances (if any) which immigrants send back have to be found from current exports. The cement might have gone into housebuilding (or the country been saved the cost of the new factory), the machinery been exported, and the capacity for heavy and automotive engineering turned to good use in providing for defence, in equipping new power stations — or making those diesel electric locomotives required by the modernization plans of British Railways. Nothing, it is fair to assume at this time, is needed for the new roads which could not be used for something else, and the real cost of the road consequently, is to be measured by the expenditure entailed in carrying out the work. It might indeed be more, if for example, work on the highway consumed or stood in the way of the manufacture of goods, the (sterling) price of which undervalued their worth as exports.

III

I have said in all this nothing about accidents. They raise a formidable problem which I do not think is susceptible to the economic calculus at all. One part of the cost of an accident can be readily assessed, as the damage to property and the expense, if any, of repairing the survivors. One can add the loss of their output while temporarily or permanently incapacitated. But what of the anguish

undergone by the victim of a smash after he has woken up, one hopes, in the hospital, and even worse, what of those who do not? The imagination is repelled by the grisly business of deducting the value of the pensions the dead are not alive to enjoy from the output the community has lost through their premature decease; and it scarcely seems worth while, pressing this appalling argument to its logical conclusion, to go to the expense of installing road safety devices in Bournemouth or other congeries of the elderly.

IV

The Conference on Road and Rail Transport meeting in 1932, only a year after the receipt in 1931 of the Final Report of the Royal Commission on Transport, had set as their object, 'the ultimate establishment of a "fair basis of competition" such as would tend to secure a better "division of function" between goods transport by road and rail respectively'. (21) The Queen's Highway, they remembered, is used for a variety of public purposes, some of which interfere more or less seriously with the motorist, as when speed limits are imposed, pedestrian crossings laid down, or the road dug up leaving a hole surrounded by barriers and red lamps. The land on which the road was built is the property in general of the frontager subject to the right of the subject to pass upon his lawful occasions. No rent is allowed for the value of this easement nor has payment been made for the capital sunk in road surfaces and foundations. Being able to measure neither the one nor the other, the Conference sagely put the two incommensurables equal and on opposite sides of the account. Against the 'community use' was balanced this 'legacy from the past'. Motor users as a class in the eyes of the Conference were then left liable for the whole of the current expenditure upon highways. Nothing more was to be laid on the shoulders of the private user, and the Conference undertook their considerable numerical exercises, all based on guesses, to determine the greater burden which might reasonably be laid on commercial vehicles.*

Writing some years later on this same question, I had attempted to measure what the road might have cost since 1920 (my starting date) if there had been no motor transport. The expense of providing for the motorist as a group then became the additional outlay which in fact had been incurred on that road. (22) In Nova Scotia, just before the War, new roads had indisputably been made to provide for the tourist traffic in private cars which it was hoped to

* Tax on heavy vehicles both goods and passenger (registration duty) was raised in the following year, though not quite in the amounts recommended by the Salter Conference.

attract from the United States. The ordinary Nova Scotian motorist could use this highway without qualm as to cost since what would support the American car clearly carried his own with no additional expenditure; and the commercial operator in Nova Scotia was paying all he could be asked if the proceeds of tax from that source were at least equal to the extra sum required to adapt to the requirements of bus and lorry a road already well enough constructed to withstand a somewhat rigorous climate. (23)

The problem in Nigeria, which I had the privilege of examining in 1950, was altogether simpler. There was then no community use. Indigenous overland transport by headload and pack animal (and in some parts the bicycle) needs no more than the unimproved bush path. Made roads and bridges of course, are a help. But they are required only by the motor user and the whole cost of the highway system can consequently be charged against him. (24)

The highway engineers have produced, or should be able to do so, figures showing the cost of providing foundations, carriageways and bridges adequate for the different classes of traffic. The attempt, even so, to divide the total expenditure on the road between the several classes of user meets with all the difficulties usually found in the allocation of a common overhead cost. The sum of the specific costs for which each party is severally liable is not always equal to the whole. The Chevrier Commission (25) in Ontario before the war assessed the extra cost caused by heavy vehicles at 7 per cent only of the total laid out on the provincial highways. The conclusion to be drawn from this was not of course that all other motor traffic should pay the remaining 93 per cent; but that nine-tenths or more of the expenditure had to be incurred to get a road suitable for motor traffic at all. A certain minimum outlay has to be incurred to provide a road of any sort. Once that highway is built, it can serve equally well, and without proportionate increase in cost, the purposes of one, some or all of a great many different persons and many different classes of traffic. All the users benefit from the expenditure. But there is no means whereby shares in this common overhead can be assigned except arbitrarily. The 'cost' of providing facilities for any one class of user is the cost of constructing the highway. Part of the highway is of no value to anybody. A whole highway is required and 'attempts to correlate traffic and even the surface maintenance costs, often give inconsistent and freakish results. This is because there are other factors controlling the costs which often outbalance the effect of the traffic'. (26) That was the opinion of three engineers commissioned to write on highway costs by the Association of American Railroads just before the War.

The weight and dimensions of a commercial traffic especially in developed industrial communities such as Great Britain and the United Stated probably demand additional attention to surfaces, foundations and bridges. (27) But speed too makes its claims upon alignment and width of pavement. A motor road capable of carrying a fast light traffic may need strengthening should it also be used for heavy lorries and coaches; and it will certainly need widening if the big trucks and buses for any reason go more slowly than the rest. For it is the risk of congestion, or at least, of providing against that risk which so adds to the expenditure upon the road. A road which might serve either for fast private cars or for slow and heavy lorries can become wholly inadequate when both try to use it together — the common experience today over most of the main highways of Great Britain. Once a road becomes congested, the costs of providing for the increase are no longer to be measured as a strengthening of the foundations here or a widening and realignment there. The cost now becomes the expense of providing a whole new road, or what comes to the same thing, a dual carriageway throughout the length of the existing highway and by-passes round all the towns and villages. The drivers of the lorries and buses, limited by law to maximum speeds of 20 and 30 miles an hour are content to plod along nose to tail. None may then pass — but to whom is the cost of the third and fourth lane, or of the dual carriageway to be debited, to the slow moving lorry which is in the way or the driver of the faster private car who wants to overtake?

V

Road transport has grown from nothing at the end of one war and output at the outbreak of the next must have reached at least 5 per cent of the national total. The business of carrying now produces and consumes 14 per cent and more of the gross national product. (28) £1100 millions more or less was spent on the highway between the wars and four-fifths of that amount (£820,670) was raised from the motorist, in vehicle and licence duty and petrol tax. The road had to be rebuilt to carry the motors and it is not surprising that so much more should have been spent in the first years on the highway than was collected from the motorist. The yield of tax, even without the encouragement of an increase in rates, rose by natural growth from very little to a great deal and specifically, from less than the annual expenditure upon highways to a very great deal more. (29) Expenditure was kept up and in spite of what is often implied to the contrary the roads of England were greatly improved. The writer

TABLE I

PROCEEDS OF MOTOR TAX AND GROSS EXPENDITURE ON HIGHWAYS FROM 1945

£000's

	Registration Duty	*Fuel Tax*	*Purchase Tax*	*Total Proceeds of Tax*	*Gross Expenditure*	*Issues from Consolidated Fund* (*a*)	*Grants to Highway Authorities*	*Expenditure on Trunk Roads*	*Balance remaining, to be charged against Rate Fund, etc.* (*b*)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1945	28,965	40,975	—	69,940	36,899	7,800	5,855	2,116	28,928
1946	43,172	45,122	—	88,294	43,255	8,670	6,047	2,651	34,557
1947	49,456	44,341	12,200	105,997	64,823	17,030	9,112	7,113	48,598
1948	49,108	48,088	17,200	114,396	73,728	27,170	16,423	8,565	48,740
1949	52,716	46,300	17,700	116,716	72,160	23,544	14,804	7,916	49,440
1950	55,772	50,700	24,500	130,972	79,116	24,375	15,923	9,215	53,978
1951	61,357	125,550	25,900	212,807	80,569	25,045	15,825	8,581	56,163
1952	65,211	186,339	46,300	297,850	80,670	28,169	17,628	10,059	52,983
1953	67,658	226,100	67,200	360,958	85,170	31,874	20,460	10,980	53,730
1954	73,100	237,500	76,200	386,800	89,629	33,131	21,281	11,344	57,004
1955	78,980	252,800	94,400	423,180				(*c*)	

(*a*) Road Fund was dissolved in 1954.

(*b*) Obtained as the difference between gross expenditure in col. 5 and the sum of the grants to highway authorities and the expenditure on trunk roads (cols. 7 and 8).

(*c*) £24,000,000 in 1955 according to the Civil Estimates (Class IX).

Sources: (columns 2-5), British Road Federation – *Basic Road Facts*, 1954.

(columns 6-8), *Reports of Administration of Road Fund*.

can still remember cycling from Derbyshire to Hertfordshire in 1922, before the improvement had been well begun!

It may, I suppose, be taken for granted that motorists as a class and each class of motor user should pay towards his track, in tax if

TABLE II

DISTRIBUTION OF MOTOR TAX BETWEEN THE SEVERAL CLASSES OF USERS, 1953-54

Type of Vehicle	*Numbers*	*Receipts from*			
		Fuel Tax at 2/6 a gal.	*Registration Duty*	*Purchase Tax*	*Total*
		£000's	£000's	£000's	£000's
1. Motor Cycles	1,028,014	9,638	2,500	3,200	15,338
2. Cars	2,761,622	86,301	36,000	65,000	187,301
3. Goods Vehicles (*a*)	976,307	105,560	27,300	8,000	140,860
Light (*b*)	543,862	29,368	7,800	5,500	42,668
Heavy (*c*)	432,445	76,192	19,500	2,500	98,192
4. Tractors other than £2 class	4,807	751	200	—	951
5. Hackneys (*a*)	111,935	35,234	5,800	—	41,034
Small (*d*)	36,092	3,609	2,300	—	—
Large (*e*)	75,843	31,625	3,200	—	—
Total	4,882,689	237,484 (*f*)	71,800	76,200	385,484
Grand Total	4,882,689	237,500 (*f*)	71,800	76,200	385,500

(*a*)

	Light oil	*Heavy oil*
Goods Vehicles		
Light	543,381	481
Heavy	372,994	59,451
Hackneys		
Small	36,092	—
Large	16,680	59,163

(*b*) Up to 3 tons carrying capacity.
(*c*) Over 3 tons carrying capacity.
(*d*) Up to 8 seats.
(*e*) Over 8 seats.
(*f*) Excludes £3,006,000 raised from fuel consumed by tramcars. 85 per cent of fuel, the British Road Federation estimates, is burnt by commercial or business users and 15 per cent privately.

Source: British Road Federation.

by no more direct means, a sum at least equal to the costs of providing him with a suitable road. Motorists in Great Britain as a whole are now paying this much and far more. The proceeds of tax since the middle of the nineteen-thirties has come to exceed, now very handsomely, the annual outlay, in gross, on the highways. Each class of motorist within that total, if the guesses of the British Road Federation are to be believed, appears also to be finding more than

TABLE III

EXPENDITURE UPON THE SEVERAL CLASSES OF HIGHWAY BY HEAD OF CHARGE, 1953-54

Class of Highway	*Total*		*Maintenance Repair and Minor improvements*	*Major Improvements & New Construction*	*Cleansing, Watering & Snow Clearing; Admin. expenses*	*Mileage*	*Cost a mile (approx.)* (a)
	All Sources	*Identifiable (sum of cols. 4 and 5)*					
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	£000's	£000's	£000's	£000's	£000's	(*Miles*)	£
Trunk	9,894	8,932	7,816	1,116	962	8,270	1,080
Class I	79,735	19,421	16,119	3,302	19,272	19,585	992
Class II		8,545	7,821	724		17,690	483
Class III		13,286	12,520	766		48,721	273
Unclassified		19,211	18,028	1,183		92,774	207
Total	89,629	69,395	62,304	7,091	20,234		

(a) Omitting cleansing, watering, snow clearing, and administrative expenses. The expenditure under these two general heads on trunk roads was divided in the proportion of 1 to 2 (£322,000 and £690,000 respectively).

Source: *Reports of Administration of Road Fund*, 1953-54, appendices VI and I. Moneys recoverable from frontagers, public utilities, etc. are excluded; and £706,000 in respect of trunk roads paid by the Ministry of Civil Aviation other than to agent authorities.

the sum required to reimburse highway authorities for all their outlays on his behalf. Taxis and town buses use the city streets; long distance coaches and heavy lorries stray only rarely from the main trunk roads. 'Hackneys' and heavy goods vehicles, if the comparison be permitted, were each providing much more than that £10,000,000 or so (now £24,000,000) which was being spent on the 8270 miles of 'trunk' roads which they may be presumed principally to use. (Tables II and III). There is a certain rough justice, one imagines, in expecting the private motorists, the motor cyclists (assisted always by some contribution from the country bus and the light van) to pay for the 160,000 miles of Class II, Class III and unclassified highway, since it is they who gain so much from finding wherever they may want to go, a hard surfaced paved highway along which to travel. The rate of tax on the first two groups is already far in excess of the £42 millions spent on these highways all told and it continues to be so even when a deduction is made for an allowance toward the £20,000,000 or so spent on the Class I roads and the modest expenditure on the trunk roads.

VI

There is already, in the Ministry of Transport, a body whose purpose it is to advise and oversee the construction of highways in Great Britain. The performance of the Ministry and of the local highway authorities in the past has not perhaps encouraged any great faith in their capacity to produce, at the appropriate time, which many consider is now, the system of roads which the traffic of Great Britain appears to demand. Some have argued that today's needs for roads can only be satisfied by an independent authority freed from the bounds which convention has set upon Government departments. (30) Such an authority it is true might get the roads built and more speedily — if it were constituted by men convinced of the policy urged by the proponents, free to pledge the credit of Government or with access to an independent source of revenue. Part at least of the reason for the failure of the Road Board it must be remembered, is put down by Rees Jeffreys to their very independence of Government and of Parliament which preserved their actions and policies (or lack thereof) from the criticism to which they might otherwise have been subjected (31); and the Select Committee in 1953 considered and refused a suggestion that local highway authorities should be assured a proportion of their grants over a five-year period as an assistance in formulating their programme. (32)

The motoring community have rejected a general system of tolls or other extraordinary devices. They consider, or so it appears,

that having already paid for the roads they need in taxes over these past thirty years, they should now get them. Finance, with or without an independent highways authority, remains, essentially, the problem of finding room within a forecast of national expenditure already equal to (or greater than) the national output, valued at current prices, for the additional outlays to be realized on the roads. The answer to such a question is and can only be political — or moral. By political and moral in this context is meant a judgment of what is right and (or?) expedient to be taken at the time by those finally responsible for determining the expenditure upon highways. An economic decision the writer supposes, would rest upon a valuation of the income returned by such an expenditure in relation to that expected from the investment of a like sum employed elsewhere. The purely measurable returns from an improvement to given stretches of road in petrol, oil, tyres, maintenance and (paid) time saved must in some cases already exceed this economic standard. For these expenditures upon highway improvements the justification is clear, provided always that in a fully employed economy, something else is trimmed to make room for the addition to the expenditure upon highways and that the return to the expenditure thus foregone is less than the return to the expenditure upon the highway which it is proposed should take its place. But the sum of these expenditures upon highways must needs be less than the total of the resources which should be so applied just as the measurable constituents are *ex hypothesi* less than the final total of the return. Allowance has to be made in all this for the incommensurable elements of unpaid time which is saved, for the larger convenience of private persons and traders, for the lessened frustration of the drivers and for the greater freedom from (or incidence of) accidents.

That the roads of Great Britain generally stand in need of considerable improvement and that more should therefore be spent on them must seem obvious to anyone who once has joined those long processions which meander interminably over the two-lane highways miscalled trunk roads by the unconscious humorists of the Ministry of Transport. Some trunk roads and the main roads in some counties already allow those who like to drive too fast to claim an average speed of forty miles an hour and more. So much of course cannot be said of all trunk roads nor of all county main roads, supposing indeed that the convenience of the private driver is admitted as a proper standard. Where the money should go is one question, to be decided presumably by some survey of requirements and capacities. How much more could usefully be spent is certainly

another which will occur to the economist if to nobody else.* The cost of the improvement can readily be ascertained, once the accounts have been collected and cast in the proper form; but the return to be expected from the investment is neither wholly measurable nor can it be estimated in any very precise terms.

There are unhappily no objective and commonly accepted tests by which to assess the share of the total outlay permitted by the value of the resources at the disposal of the community which could profitably be invested in highway improvement. Nobody presumably, is going seriously to suggest that the current proceeds of motor tax should, or indeed, could be spent upon road works in Great Britain, without effectively dislocating other plans for expenditure and without adding substantially to the dangers of inflation; and no Chancellor, with defence and the welfare state among the claims he has to meet, could be expected to forego the large and valuable revenue that the Treasury now collects from the ill-used motorist. The motorist, unfortunately for himself, consumes a service the demand for which appears to be singularly inelastic, singularly unresponsive that is, to increases of price. This is a characteristic he shares to his detriment with the smoker and the drinker, and it may be with the recipient of income. Motoring upon one's private occasions is an indulgence like any other. But motoring is also a business venture and the motorist in business pays for use of his instrument just as the private person who seeks only his own pleasure. The user of the motor for his own private purposes has no more and no less cause for complaint if he is taxed than anybody else who is mulcted for the privilege of gratifying his appetites. Against the taxation of motoring as a business there can be urged the objection that the levy of the tax, by raising costs in that particular occupation compared with others which are untaxed, correspondingly diminishes the incentive to invest in the taxed enterprise and so contributes to misallocation of national resources. In theory the argument is irresistible; but the commercial motor user and the business user of the private car will have to produce a weightier case than I have yet been privileged to see before they can convince Chancellors of the day that motor taxes, any more than the taxes on baccy and booze are dangerously high!

* Some work is now being done on this by Dr. Michael Beesley of the University of Birmingham in collaboration with the Road Research Laboratory, Department of Scientific and Industrial Research, financed in part by Conditional Aid and in part by departmental funds. The results, it is hoped, will be published in due course.

THE FACULTY OF COMMERCE AND SOCIAL SCIENCE,
UNIVERSITY OF BIRMINGHAM

REFERENCES

(1) Rees Jeffreys, *Kings Highway*, p. 3.
(2) Rees Jeffreys, *Kings Highway*, p. 7. Webb, *English Local Government*, p. 243.
(3) Finance (1909-10) Act, 1909, Sections 84, 86 and 90. Development and Road Improvement Fund Act, 1909. The relevant passages from Hansard are reproduced by the British Road Federation in their *Basic Road Facts*, 1954, p. 42.
(4) Roads Act, Section 3 (4).
(5) Development and Road Improvement Funds Act, 1909, Section 7 and 8.
(6) 256 H.C. 301-2.
(7) Sir Edgar Harper, sometime Chief Valuation Officer, Board of Inland Revenue, *The Times*, February 5th, 1926 (quoted by Rees Jeffreys, *Kings Highway*, p. 58).
(8) Select Committee on Estimates: Fifth Report, Session 1952/3, paragraph 3.
(9) All instructively set out, and much more besides, in the Fifth Report from the Select Committee on Estimates, Session 1952/3.
(10) Select Committee on Estimates: Fifth Report, Session 1952/3. Walker, *Economic Planning by Programme and Control* (London, Heinemann) chap. v.
(11) Select Committee on Estimates: Fifth Report Session 1952/3. Walker, Beesley and Walters, *Westminster Bank Review*, May 1953, p. 8, table II.
(12) 536 H.C. 1100, and 1111-13
(13) Walker, *Road and Rail*, chap. IV (3); Walker, *Westminster Bank Review*, August 1950, and a contribution, jointly with C. I. Savage, to a series of essays on British productivity, edited by D. L. Burn.
(14) Wilfred Owen, *Toll Roads* (The Brookings Institution).
(15) Dupuit, *Annals des Ponts et Chausses*, Paris 1844 (quoted by Henderson in the *Manchester School*, 1947, vol. XV, p. 223).
(16) 536 H.C. 1103.
(17) *Manchester Guardian*, October 14th and 21st, 1955.
(18) Chesterton, *Flying Inn*, 'Before the Romans Came to Rye'. Walters, 'Track Costs', *The Journal of Industrial Economics*, April 1954.
(19) Walker, *Economic Planning by Programme and Control* (London, Heinemann) particularly chap. II and chap. VIII; and Walker and Walters, 'Social Accounting' in the *Accounting Field*, edited by Cousins.
(20) Walker, Beesley and Walters, *Westminster Bank Review*, May 1953, p. 8.
(21) *Conference on Road and Rail Transport*, (Salter) Report, July 1952, p. 6.
(22) Walker, *Road and Rail* (1942), table III, p. 27.
(23) Walker, *Road and Rail Transport in Nova Scotia 1939*. (Reports of the Nova Scotia Economic Council, vol. VI, no. 48: King's Printer, Halifax, December 1941, particularly Section 6).
(24) This study is now in preparation.
(25) *Report of Royal Commission on Transportation*; Province of Ontario, pp. 11 and 228.
(26) Breed, Older and Downes, *Highway Costs*, p. 81.
(27) Bendiner, 'The Engineering of Consent: a case study' *Reporter* (New York), August 11th, 1955.
(28) Rudd, 'Estimates of expenditure on road transport in Great Britain', (*Journal of the Royal Statistical Society* (Series A, General vol. CXV, part II, 1952, pp. 179-91)); Glover and Miller, 'Outlines of the Road Goods Transport Industry' *Journal of the Royal Statistical Society* (Series A, General vol. CXVII, part III, 1954, pp. 297-330); Walker, 'New Thinking in Transport', *Journal of Institute of Transport*, July 1955, pp. 159-65.
(29) *Reports of Administration of Road Fund*, 1922/3 to 1953/4 inclusive: *Basic Road Facts*, 1955 (published by British Road Federation).
(30) Ponsonby, *Lloyds Bank Review*, January 1955; *Municipal Engineering*, November 1955.
(31) Rees Jeffreys, *Kings Highway*, chap. IV, pp. 34ff.
(32) Select Committee on Estimates: Fifth Report, Session 1953/4, paras 16-17.

CONCENTRATION, SCALE AND TECHNOLOGICAL CHANGE IN SELECTED MANUFACTURING INDUSTRIES 1899-1939*

by ALMARIN PHILLIPS

I

INTRODUCTION

AN interesting argument has been advanced recently by Professor J. K. Galbraith. 'A benign Providence,' says Galbraith, 'who, so far, has loved us for our worries, has made the modern industry of a few large firms an almost perfect instrument for inducing technical change.'[1] This is alleged for two reasons: it gives firms the financial ability to undertake technical development and it provides the incentives necessary for innovating. Research and development, it is argued, are expensive and risky in our modern age. Only large firms can afford the effort. And unless the firm has substantial market control, precluding effective price competition while allowing for technical changes, the returns from the innovation are apt to fall into the hands of imitators before the innovator has reaped his rewards.[2] Galbraith's hypothesis can be subjected to some empirical tests. Specifically, we can test whether industries in which production is concentrated in a few firms and in which firms are large relative to those in other industries tend to display more evidences of technical change than do industries in which either or both of these conditions do not exist. That is the purpose of this paper.

II

THE SOURCES AND LIMITATIONS OF THE DATA

(a) *The Industries* — The classification of the twenty-eight industries included is that of the United States Bureau of the Census. Their titles and the 1947 Standard Industrial Classification equivalents are given in Table I.[3] The industries do not represent a random

* The author wishes to acknowledge with thanks the kindness of the Committee on the Advancement of Research, University of Pennsylvania, for the grant which made this study possible. He is also indebted to Professor J. K. Galbraith, Harvard University, and to Professors R. A. Easterlin, I. B. Kravis and S. Weintraub, University of Pennsylvania, for helpful criticisms of an early draft.

[1] John Kenneth Galbraith, *American Capitalism* (Cambridge, 1952), p. 91.

[2] For an excellent discussion of some of the theoretical considerations involved, see P. Hennipman, 'Monopoly: Impediment or Stimulus to Economic Progress?' in *Monopoly and Competition and their Regulation* (London, 1954), Edward H. Chamberlin (ed.).

[3] I am indebted to Mr. Saul Sands for his tracing of industry classifications from census to census to maintain consistent definitions and for the computation of measures of establishment concentration for 1904 and 1939.

sample of all Census of Manufactures industries. Rather, they are the industries for which adequate data are available. They cover a wide range of activities but, unfortunately, do not include industries from some important manufacturing activities. The fabric apparel,

TABLE I

INDUSTRIES COVERED

Industry	*1947 SIC Equivalent*
1. Beet sugar	2063
2. Butter	2021
3. Cheese	2022
4. Fruits and vegetables, canned	2033, 2034, 2035 and 2037
5. Ice, manufactured	2097
6. Fish, canned	2031 and 2032
7. Flour	2041
8. Meat packing	2011
9. Rice	2044
10. Tobacco, chewing and smoking	2131
11. Woollen and worsted goods	n.a*
12. Leather	3111
13. Shoes, leather	3141 and 3142
14. Paper and pulp	2611 and 2612
15. Explosives	2826
16. Fertilizers	2871 and 2872
17. Paints and varnishes	2851, 2852 and 2853
18. Cotton seed products	2881
19. Soap	2841
20. Salt	2898
21. Petroleum refining	2911
22. Coke oven products	2931 and 2932
23. Cement	3241
24. Blast furnace products	3311
25. Steel mill products	3312 and 3323
26. Copper	3331
27. Lead	3332
28. Zinc	3333

* No combination of 1947 SIC numbers produces an industry of exactly equivalent composition to that used by the Census from 1899 to 1939.

fabricated metal products, machinery, electrical machinery and transportation groups, in which many technological changes have occurred, are noticeably absent. Industries from these groups either were not given separate census classifications in the early years of the century or their classifications have shifted so as to make consistent reporting impossible.

In addition to being a non-random sample of industries, those chosen are but a small fraction of total manufacturing. The twenty-eight industries accounted for about 2 per cent of total value added in manufacturing in both 1904 and 1939.

(b) *Production* — Production is measured by Fabricant's indexes of

physical output in all cases.[4] These indexes are derived from values of output deflated with the Edgeworth price index formula.

(c) *Concentration* — The measures of concentration used are the 1904 and 1939 *establishment* concentration ratios, giving the estimated percentage of total industry output accounted for by the largest twenty establishments.[5] In view of the hypothesis investigated, it would clearly be preferable to use firm concentration data, but these do not exist for the early years. Studies for recent years show significant correlation between establishment and firm concentration[6] and one would suppose that, were the information at hand, the correlation would be at least as great for past years as it is presently. Spearman's measure of rank correlation between the percentage of total output accounted for by the four largest firms in 1947[7] and the twenty largest establishments in 1939 is + .83 for the twenty-one industries for which both measures can be found. The industries which deviate most from the correlation are rice, chewing and smoking tobacco, leather and zinc, in which firm concentration was lower than average relative to establishment concentration, and petroleum refining, in which firm concentration was higher than average relative to establishment concentration.

The rank correlation between the percentage of total production accounted for by the twenty largest establishments in 1939 as against the same measure for 1904 is + .73 for twenty-six of the industries. Canned fish, flour, paper and pulp and petroleum refining are the more significant exceptions, the first two having increasing establishment concentration and the others decreasing.

The concentration in the earlier year, 1904, seems the more pertinent since the Galbraith position assigns a causative or, at least, permissive role to concentration at a given time and the technical changes which take place subsequently. In view of the fairly high correlation between the 1904 and 1939 establishment concentration and the 1947 firm concentration, the general conclusions do not

[4] Solomon Fabricant, *The Output of Manufacturing Industries, 1899-1937*, (New York, 1940).

[5] For both 1904 and 1939, a linear interpolation of Census distributions of the value of production by establishment size classes was used to estimate the percentage of total industry output accounted for by the largest twenty establishments. Data for 1904 come from retabulations of the 1904 returns published in Censuses subsequent to 1904. A complete summary of the sources of the 1904 concentration ratios is available.

[6] The *Report of the Federal Trade Commission on Changes in Concentration in Manufacturing, 1935 to 1947 and 1950*, Appendix E, gives plant concentration ratios, based on employment data, for 112 industries. The rank correlation between these ratios and the concentration ratios for the four largest firms in the industries, given in Appendix D, Table I, is + .79. See also the *Report of the Federal Trade Commission on the Divergence Between Plant and Company Concentration, 1947*.

[7] *Report of the Federal Trade Commission on Changes in Concentration in Manufacturing 1935 to 1947 and 1950*, Appendix D, Table I.

depend on the use of any one of them. On some specific points, the findings vary if the 1939 or 1947 concentration measures are used instead of the 1904. Where this is the case, it is noted in the text.

(d) *Scale* — As in the measurement of concentration, information concerning scale is not available for firms. Consequently, it is again necessary to use establishment data. In this case capital per establishment and the number of wage earners per establishment have been used as indexes of the scale of the producing units in each industry.[9]

For 1904, the rank correlation between the capital per establishment and the establishment concentration ratios of the industries is +.59, significant for the twenty-two industries for which the data are available. The correlation between wage earners per establishment and concentration is only +.38 for 1904 for twenty-six industries. This is also significant at the .05 level. Thus, as would be expected, concentration, at least in 1904, is associated with scale of plant, especially when the latter is measured by capital per establishment.

(e) *Technological Change* — It has been maintained that economic progress means a change in the relation between inputs and outputs.[9] The most widely recognized quantitative measure of such progress is the ratio of total output to labour input, the productivity of human effort. The best indicators of this for the industries and period covered by the present study are the indexes of employment per unit of output prepared by Fabricant.[10] These give, for each of the Census years from 1899 or 1904 to 1939, the number of wage earners per constant dollar of output, expressed as a relative to the 1929 value for each industry. From them, it is possible to compare the improvements in labour productivity for the various industries. A large reduction in employment per unit of output is, by implication, better performance than a small reduction. It would have been preferable to use the man-hours rather than the number of wage earners. Estimation procedures for such computations would have been so crude, however, that it was not attempted. Moreover, so long as the hours per year of wage earners in the various industries did not change greatly in relation to each other, no differences are likely to arise in the results.

[9] Capital data are acknowledged by the Census to be 'of little value' (Thirteenth Census of the United States, 1910, vol. VIII, Manufactures, p. 21). This was felt because of the large number of concerns which kept no capital accounts, the frequent failure to allow for depreciation and obsolescence, non-uniform valuation methods and possible duplication. 'Capital' includes the value of land and buildings (if owned), machinery and tools, materials, stocks in process, finished products, fuel and supplies as well as cash and trading and operating accounts and bills receivable. The results below suggest, despite the pessimism of the Census, that the data do have some value.

[9] K. E. Boulding, 'Economic Progress as a Goal of Economic Life,' in A. Dudley Ward (ed.), *Goals of Economic Life* (New York, 1953), pp. 52ff.

[10] Solomon Fabricant, *Employment in Manufacturing, 1899-1939*, (New York, 1942).

Other ratios of input-to-output may also give evidence to technological change. Capital-output ratios would be of particular interest. The collection of capital data was discontinued, however, after the Census of Manufactures for 1919. Estimates of capital made at the National Bureau of Economic Research for the years after 1919 do not give data for most of the twenty-eight industries included here.[11] The Census did continue its collection of total horsepower[12] through 1939. These provide another input-output ratio, horsepower per unit of output, as well as a ratio of input-to-input, horsepower per wage earner. Interpreting either of these as indicators of technological development is subject to some difficulty. In general, their interpretation should complement the analysis of employment per unit of output. Given the values for employment per unit of output and horsepower per unit of output, the value for horsepower per employee is determined. In subsequent discussion it will be noted that industries in which employment per unit of output is decreasing at relatively rapid rates tend to have relatively high rates of increase in horsepower per employee. It follows, of course, that the same industries tend to have more rapid rates of increase or slower rates of decrease in horsepower per unit of output than do the other industries. The problem is to place the proper interpretation on such results. Does this indicate technological change or merely increasing labour productivity due to a relative increase in the use of other factors of production with respect to labour?

The observed decreases in employment per unit of output and the coincident increases in horsepower per employee could be a response to changes in the relative prices of these factors. It is undoubtedly true that the price of labour increased substantially relative to the price of power during the period 1899 to 1939, and this would have tended to produce such results. Since there are large differences in the rates of decrease in employment per unit of output and in the rates of increase in horsepower per employee among the several industries, interpreting the results as being due to price-induced substitution effects would have to further assume that either the factor price changes experienced by the various industries or the elasticities of substitution of the production functions of the industries were different.

Interpreting the differing rates of decrease in employment per

[11] Daniel Creamer, *Capital and Output Trends in Manufacturing Industries, 1880-1948*, National Bureau of Economic Research, Occasional Paper No. 41, 1954.

[12] Total horsepower is 'the combined rated horsepower capacity of prime movers – engines, turbines, and water-wheels – and of electric motors driven by purchased energy'. (Census of Manufactures: 1929, vol. I, p. 8).

unit of output and rates of increase in horsepower per employee as indicators of varying rates of technological change in the industries is tantamount to asserting that the factor price effects have not been a significant cause of the factor substitution. Such an interpretation might rest on the assumption that the typical iso-product contour in manufacturing processes is right-angled, producing an elasticity of substitution of zero. This highly restrictive assumption is not the only ground for maintaining this position, however. Another possibility is that while firms have a choice of alternative factor combinations, the range of choices is not infinite, as suggested by smooth and continuous iso-product curves, but rather is restricted to only a few combinations. In such a case, only 'large' changes in relative factor prices would induce factor substitution. Finally, even if the choices of factor combinations are infinite, it could be argued that the effects of technological changes on production functions are so much more important than price effects in influencing factor combinations, especially over long periods of time, that any observed changes in combination are predominantly due to technology.

In the discussion below, the rates of decrease in employment per unit of output and the coincident rates of increase in horsepower per employee, will be taken as evidence of the amount of technological change in the industries. It is admitted that these are not infallible criteria.

III

CONCENTRATION, SCALE AND THE RATE OF CHANGE IN TOTAL OUTPUT

The rate of change in total output cannot be used as an index of technological change. Technical changes which reduce costs or improve the product must influence output, but demand is such an important element that no simple generalizations are possible. Still it is necessary to investigate the relationships between output and scale and concentration for several reasons. Most important is that it may prevent conclusions from being drawn from spurious correlations. Correlation between concentration and output and between scale and output ought to be noted so that it may be determined whether later correlations between concentration or scale and the indexes of technological change could, in fact, be only correlations with output. Also, there is interest in knowing whether the rates of growth in output are associated with the amount of concentration or with changes in the concentration during the period.

Trends of Fabricant's indexes of total output for the industries were fitted for the years 1899 through 1939 by the method of semi-averages. The slopes of the trends are the average annual changes

in the indexes of total output. These and the measures of concentration and scale were arrayed from low to high values. The rank correlation between the average rates of change in the indexes of total output and the 1904 establishment concentration ratio was +.17; that with the 1939 establishment concentrations, −.28, and with the 1947 firm concentration, −.23. None of these is significant at the .05 level, but the change in signs between 1904 and the later years does agree with the finding of significant inverse rank correlation (−.55) between the absolute change in establishment concentration between 1904 and 1939 and the rates of change in the indexes of output. That is, concentration tended to increase most in industries with relatively slow rates of increase in total output. The biggest increases in establishment concentration between 1904 and 1939 were in the salt, chewing and smoking tobacco, canned fish and copper industries, all of which had average rates of increase in total output of less than the average for all industries. The largest decreases in establishment concentration were in industries whose output grew faster than average — petroleum refining, beet sugar and paints and varnishes.

There is no significant association between the rates of change in indexes of total output and the number of wage earners per establishment in either 1904 or 1939 or with the capital per establishment in 1904. Hence, taken separately, neither concentrations nor scale is significantly associated with the rates of change in total output.

There are interesting results if industries are divided into four classes which combine the measures of scale and concentration. The 22 industries for which capital per establishment information is available for 1904 are separated into those with: (1) below median capital per establishment and below median concentration; (2) below median capital per establishment and above median concentration; (3) above median capital per establishment and below median concentration; and (4) above median capital per establishment and above median concentration. As Table II shows, there are 8, 3, 3 and 8 industries in the respective groups, the relatively few in the second and third because of the positive association between scale and concentration noted above. The average of the average rates of annual increase in the indexes of output for industries in the groups are +1.0, +1.7, +1.7, and +1.8, in that order.[13] The differences among these are not nearly significant. But when the last three groups are combined into one — comprised of industries with either high concentration or large scale, or both — and this is

[13] The average annual increase in the index of output for all manufacturing industries, which includes the influence of new industries entering during the period, is 1.9.

compared with the first group in which the industries have neither large-scale plants nor high concentration, a difference as great or greater than that which appears would occur by chance only slightly more than one time in twenty. Thus, the data suggests that if the

TABLE II

AVERAGE ANNUAL RATES OF INCREASE IN INDEXES OF TOTAL OUTPUT, 1899-1939
22 MANUFACTURING INDUSTRIES

Industries with Below Median Capital per Establishment, 1904				*Industries with Above Median Capital per Establishment, 1904*			
Industries with Below Median Establishment Concentration Ratios, 1904		*Industries with Above Median Establishment Concentration Ratios, 1904*		*Industries with Below Median Establishment Concentration Ratios, 1904*		*Industries with Above Median Establishment Concentration Ratios, 1904*	
Industry	*Average*	*Industry*	*Average*	*Industry*	*Average*	*Industry*	*Average*
Flour	—0.4	Salt	1.1	Blast furnace products	1.0	Lead†	0.7
Cotton seed products	0.1	Soap*	1.9	Steel mill products	1.5	Copper†	1.1
Leather	0.8	Rice	2.2	Paper and Pulp	2.5	Explosives	1.3
Leather shoes	1.0					Zinc†	1.4
Meat packing	1.1					Cement*	1.5
Fertilizers	1.2					Coke oven products	1.8
Paint and varnishes	2.1					Beet sugar	3.2
Manufactured ice	2.4					Petroleum refining	3.4
Average of Averages	1.0		1.7		1.7		1.8

* Indexes of output and of employment are not available for these industries for 1899. The average rates of increase in the indexes were computed by using data from 1904 only.

† Indexes of output and of employment are not available for these industries for 1939. The average rates of increase in the indexes were computed by using data through 1937 only.

true relationship were one in which the less concentrated and smaller scale industries were growing more rapidly, it would be very unlikely that the results would have appeared this way. Still, it can not be said with a significant degree of probability that there is positive association between the rates of increase in total output and either scale or concentration or both.

IV

CONCENTRATION, SCALE AND THE RATES OF CHANGE IN THE NUMBER OF WAGE EARNERS PER UNIT OF OUTPUT

Trends were fitted to the indexes of the number of wage earners per unit of output in the same manner as for total output. The

slopes of these trends — negative in every case — were then compared with the measures of concentration and scale.

The coefficient of rank correlation between the 1904 establishment concentration ratios and the average annual rates of decrease in indexes of wage earners per unit of output is +.59 for the 26 industries with data. This is highly significant. The rank correlation of the average rates of decrease in indexes of wage earners per unit of output with both the 1939 establishment concentration and the 1947 firm concentration is +.37, nearly significant at the .05 level. The more concentrated industries tend to have larger increases in labour productivity. The industries for which correlation is poorest are manufactured ice and canned fruits and vegetables, both with very low concentration and above average rates of decrease in employment per unit output, blast furnace products, with average concentration but a high rate of decrease in employment per unit, and soap, with high concentration and about average decreases in employment per unit output. Possible explanations for the failure of correlation in these cases are developed below.

The coefficient of rank correlation between the 1904 capital per establishment and the average annual rates of decrease in the indexes of employment per unit is + .65, again highly significant. Major exceptions to the correlation are manufactured ice, with very little capital per establishment and, as noted, substantial decreases in employment per unit; steel-mill products, with large capital per establishment but only small decreases in employment per unit; and the meat-packing industry, with slightly less than average capital per establishment and the smallest average rate of decrease in employment per unit of any of the industries.

The association between wage earners per establishment, 1904, and the rates of decrease in the indexes of employment per unit is not significant at +.35. Neither is the association of the decrease in employment per unit and the relative increase in wage earners per establishment between 1904 and 1939. The differences between the establishment concentration ratios in 1904 and 1939 are not associated with the rates of decrease in employment per unit even though they were with the rates of increase in output.

Table III lists the industries by combined capital per establishment, 1904, and establishment concentration ratios, 1904, as was done in Table II. The differences among the four classes are significant beyond the .01 level, indicating that the industries in which there are both high concentration and large-scale establishments tend to experience greater decreases in labour requirements per unit of output than do the other industries. Their performance, by this

standard, is preferable to that of any other group of industries.[14]

This finding may explain the failure of some industries to conform with the rank correlation between rates of decrease in employment per unit and concentration or scale. For example, the soap industry

TABLE III

AVERAGE ANNUAL RATES OF DECREASE IN INDEXES OF NUMBER OF WAGE EARNERS PER UNIT OUTPUT, 1899-1939. 22 MANUFACTURING INDUSTRIES

Industries with Below Median Capital per Establishment, 1904				*Industries with Above Median Capital per Establishment, 1904*			
Industries with Below Median Establishment Concentration Ratios, 1904		*Industries with Above Median Establishment Concentration Ratios, 1904*		*Industries with Below Median Establishment Concentration Ratios, 1904*		*Industries with Above Median Establishment Concentration Ratios, 1904*	
Industry	*Average*	*Industry*	*Average*	*Industry*	*Average*	*Industry*	*Average*
Meat packing	0.1	Salt	1.4	Steel mill products	1.5	Zinc†	2.5
Leather shoes	0.5	Soap•	2.0	Paper and Pulp	2.8	Cement•	4.0
Cotton seed products	1.1	Rice	2.4	Blast furnace products	8.8	Explosives	4.7
Flour	1.3					Petroleum refining	5.0
Paints and varnishes	1.3					Coke oven products	5.2
Leather	1.9					Beet sugar	6.0
Fertilizers	2.5					Copper†	6.4
Manufactured ice	4.2					Lead†	7.8
Average of averages	1.6		1.9		4.4		5.2

• Indexes of output and of employment are not available for these industries for 1899. The average rates of decrease in the indexes were computed by using data from 1904 only.

† Indexes of output and of employment are not available for these industries for 1939. The average rates of decrease in the indexes were computed by using data through 1937 only.

was found to be relatively highly concentrated in 1904 and 1939. It ranked, going from low to high, 21st and 19th of twenty-six industries in those years respectively. Yet its rate of decrease in employment per unit was less than average, contrary to the general relationship found. In Tables II and III, soap appears as an industry of low capital per establishment even though the concentration is high. It ranked only seventh, again going from low to high, of twenty-two industries in this category in 1904. It ranked eighth of twenty-six industries and ninth of twenty-four industries in 1904 and 1939, respectively, in wage earners per establishment. Scale was small while concentration was high. The industry did not appear an exception to

[14] The average rate of decrease in the index of wage earners per unit of output for all manufacturing industries is 3.0, considerably lower than that for the high concentration, large-scale group.

the correlation of capital per establishment and the rates of decrease in employment per unit. Similarly, the steel-mill products industry contributed to the correlation between concentration and the decrease in employment per unit, but was an exception to the correlation between capital per establishment and the decrease in employment per unit. It had large plants but relatively little concentration.

The blast furnace products industry also had large plants and relatively little concentration, but Table III shows it to have the largest rate of decrease in employment per unit of any industry. It still appears an exception to the findings. This industry ranks 10th of 22 industries in the 1904 establishment concentration ratios. The largest twenty plants produced an estimated 30.5 per cent of total output as contrasted with 37.7 per cent for rice which falls into the high concentration category. By 1947 *firm* concentration ratios, arrayed from low to high, the blast furnace products industry ranks eighteenth of twenty-three, well above median. It may easily be that classification of this industry into the lower concentration group is erroneous. Firm concentration, which cannot be computed for 1904, might place it among the higher concentration industries.

The manufactured ice industry, an exception to both rank correlations, is an extremely localized industry for which national concentration measures may have little significance. The canned fruits and vegetables industry, an exception to the correlation between concentration and decrease in employment per unit, is not included in Tables II and III because of an absence of capital per establishment information. However, it ranks high in the array of wage earners per establishment, suggesting that, had that information been available, the industry would have added to the positive correlation between capital per establishment and the decrease in employment per unit.

V

CONCENTRATION, SCALE AND THE RATES OF CHANGE IN HORSEPOWER PER WAGE EARNER

Positive correlation appeared between the rates of change in the indexes of horsepower per wage earner and the measures of concentration and scale. Only that with the 1904 establishment concentration ratios was high enough to be significant with the .05 criterion. Table IV shows that the rate of increase in horsepower per wage earner is generally higher for industries of above median capital per establishment and above median establishment concentration in

1904. The difference between the average for this group of industries and all the rest is significant at the .05 level; the differences among the rest are not nearly so. A comparison of Tables III and IV shows some striking similarities. In general, industries with high rates of

TABLE IV

AVERAGE ANNUAL RATES OF INCREASE IN INDEXES OF HORSEPOWER PER WAGE EARNER, 1899-1939. 19 MANUFACTURING INDUSTRIES

Industries with Below Median Capital per Establishment, 1904				*Industries with Above Median Capital per Establishment, 1904*			
Industries with Below Median Establishment Concentration Ratios, 1904		*Industries with Above Median Establishment Concentration Ratios, 1904*		*Industries with Below Median Establishment Concentration Ratios, 1904*		*Industries with Above Median Establishment Concentration Ratios, 1904*	
Industry	*Average*	*Industry*	*Average*	*Industry*	*Average*	*Industry*	*Average*
Flour	0.4	Rice	0.1	Paper and Pulp	1.2	Explosives	1.6
Leather shoes	1.2	Salt	2.3	Steel mill products	2.0	Beet sugar	2.1
Leather	1.3	Soap*	2.4	Blast furnace products	3.2	Cement*	3.2
Cotton seed products	1.8					Coke oven products	3.7
Paints and varnishes	2.2					Petroleum refining	4.1
Meat packing	2.3						
Fertilizers	2.7						
Manufactured ice	3.1						
Average of averages	1.9		1.6		2.1		2.9

* Indexes of employment and of total horsepower are not available for these industries for 1899. The average rates of increase in the indexes were computed by using data from 1904 only.

decrease in employment per unit have high rates of increase in horsepower per employee, tending to confirm the evidence of more technological change in the highly concentrated large-scale industries. Yet there are exceptions. Meat packing has little change in employment per unit output but fairly substantial increases in horsepower per employee. Rice has just the opposite characteristics. Even in the large-scale, heavy concentration groups, the ordering of the five industries common to each table is different.[18] The coefficient of rank correlation between the rates of decrease in the number of wage earners per unit output and the rates of increase in horsepower per wage earner is +.47 for twenty-five industries.

[18] Copper, lead and zinc are omitted from Table IV because of the lack of data on horsepower after 1929.

VI

CONCENTRATION, SCALE AND THE RATES OF CHANGE IN HORSEPOWER PER UNIT OF OUTPUT

The rates of change in the indexes of horsepower per unit of output do not have significant correlation with either the measures of concentration or the measures of scale. Six of twenty-five industries experienced decreasing trends of horsepower-output ratios; the remainder had increasing trends. Combining scale and concentration did not produce significant differences among the industries and hence does not refute the view that the change in horsepower per unit of output is independent of scale and concentration. One might have anticipated that, since there were significant differences in the rates of change in employment per unit output by scale and concentration of industries, there would have been significant differences here. There is the interesting possibility that there is negative correlation between the rates of decrease in the indexes of employment per unit output and the rates of increase in horsepower per unit output. That is, industries in which employment per unit output decreased the most might, in general, have a higher rate of growth in power per unit output. In fact, the rank correlation is only $-.23$ for 25 industries.

VII

THE HIGHEST CONCENTRATION, LARGEST-SCALE INDUSTRIES

The possibility exists that, even though the large-scale, high concentration industries appear to have at least as great economic changes as other industries, the *largest* scale, *highest* concentration industries do not share this behaviour. The lead, copper and petroleum refining industries are the most concentrated and largest scale of those in this study. Lead had the highest plant concentration ratio (98.1 per cent) and the largest capital per establishment in 1904. Copper had the fourth largest concentration ratio and next to the greatest capital per establishment. Petroleum refining was next to the highest in concentration, and had the fourth largest capital per establishment. Lead and copper had relatively slow rates of increase in total output. The three industries together have an average rate of increase in indexes of total output of 1.7, about the same as the large-scale, high concentration group from which they are chosen. The average of the rates of decrease in the indexes of wage earners per unit of output for the three is 6.4 as contrasted with 5.2. for the larger group. Of these industries, only petroleum refining has horsepower per employee data. The rate of increase in horsepower per employee for it was the greatest of all the industries shown in Table IV.

VIII

CONCLUSIONS

We set out to test whether industries in which production is concentrated in a few firms and in which firms are relatively large tend to show greater evidence of technical change than do industries in which either or both of these conditions do not exist. In general, it has been found that such industries do show more signs of such changes. Of the industries studied, those which were highly concentrated and had large-scale producing units in 1904 had significantly greater rates of decrease in the number of wage earners per unit of output between 1899 and 1939 than did the other industries. They also tended to have larger rates of increase in the amount of horsepower per wage earner. These changes are not likely to be due to the fact that their output was increasing more rapidly than that of other industries, since there was no significant difference between the rates of increase in output for this group as contrasted with the others.

These results must be interpreted with extreme caution. Since concentration ratios do not measure monopoly power, the results have no direct bearing on relations between monopoly and technological change. In fact, they do little to prove even the relationship between scale and concentration, on the one hand, and technical change on the other, for several reasons which may bear repetition. Establishment information has been substituted for the more relevant firm information. This may have led to incorrect findings, though the correlation between the establishment and firm data is high enough to make the probability of this small. The indicators of technical change — the rates of decrease in wage earners per unit of output and the rates of increase in horsepower per wage earner — are not adequate to show the many forms which technical change may take or to exclude the influence of changing factor prices. Perhaps their most important deficiency is their failure to indicate changes in the characteristics of the products being produced. Moreover, the sample of industries is very small and may not be representative of manufacturing industries in general.

By far the most important reason for cautious interpretation would remain even if firm data, better measures of technological change and a larger sample were used. That reason arises from the problem of assigning a direction of causation to the findings. We have found evidence of association between concentration and scale and the rate of technical change. The association could be because there were certain characteristics of concentration and scale which foster technical development as Galbraith, for example, suggests or it could be due

to technical changes having effects on concentration and scale.[16] It is also possible that concentration, scale and technical change may be associated with unobserved variables which are causative with respect to both. The simple correlation and variance techniques used in the present analysis are incapable of solving this 'chicken-and-egg' problem. Yet it is the cause and effect relationship which is of primary interest.

With all these qualifications, there remain two important conclusions. The first is best placed in a negative way. No evidence has been found which suggests an inverse relationship between technological change and production concentrated in a relatively small number of large producing units. The alternative hypothesis that industries with large numbers of small firms tend to be technologically more progressive, while not disproved, received no support from the data. The second conclusion follows from the first. It is important that we know more about whatever relationships there are between scale and concentration and technological development. Continued empirical research in this area should provide additional measurable aspects of industry and market structures and better measures of technical change. Such research is indispensable for testing hypotheses on which deductive reasoning is based, for suggesting additional hypotheses concerning the relations between various market and industry structures and technical change, and ultimately adding to our understanding of the problems and policies in this important area of economics.

[16] The hypothesis that concentration and scale are a result of technological changes is suggested by Arthur R. Burns, *The Decline of Competition* (New York, 1936), pp. 8-9.

UNIVERSITY OF PENNSYLVANIA

PRODUCTIVITY IN A PRINTING FIRM

by F. A. Wells

I

The late Dr. Rostas has pointed out[1] 'that there is very little precise knowledge available of what happened to productivity in the last ten years either in the British economy as a whole or in its various sectors'. He has also reminded us that 'we can say little on the relative importance of the various factors affecting productivity'. His conclusion was that 'really reliable information on changes in productivity within individual industries and a worth-while analysis of the factors determining such changes must wait until field studies of plant records are made directly for this purpose'.

At Nottingham University we have been enabled to undertake a number of such field studies.[2] Although the work is far from complete, it may be useful to give some account of our method and findings, particularly as a means of exchanging experience with others who may be pursuing this line of investigation.

Our method is to take the firm as the unit for investigation; to measure the changes in its productivity over a period of time, extending where possible to pre-war years; and to seek the causes of changing productivity. In particular, we want to know what makes a firm productivity-conscious; how a firm tries to increase productivity; what obstacles it meets and how it tries to overcome them.

This article is mainly concerned with the results of an investigation in a large firm of general printers. Fortunately the firm had a continuous series of records and accounts going back to 1930, while its products and scale of operations were similar to those of pre-war days. Our choice of this firm was also fortunate in another respect: the management were concerned about productivity. The extent of this concern, we have found, varies very much from firm to firm. To increase productivity, as distinct from merely running the business, requires an impetus, a willingness to take risks, persistence in overcoming obstacles, and then sustained effort and constant vigilance to prevent a slipping back. All this emphasizes the responsibility of management. Much attention has been directed to the

[1] In an article on 'Changes in the Productivity of British Industry', *Economic Journal*, March 1952.

[2] This has been made possible by a grant under the Conditional Aid Scheme for the use of Counterpart Funds derived from United States Economic Aid.

I wish also to acknowledge the generosity of the firms which have co-operated in the project and the contributions of Mr. S. Maxwell, Dr. I. F. Pearce and Miss M. F. Robertson as members of the research team.

attitude of labour and to labour-management relations in the investigation of productivity problems; but do we know enough about the motives of management itself?

In the present case one reason for management's concern was in the profits record. It has become fashionable in contemporary studies of business behaviour to depreciate the importance of the profit motive. We can only say that nothing in our investigation of this and other firms suggests that the business man has ceased to be interested in profit. He can reasonably claim that increased profit is an indication of the increased productivity of the business; its resources are now earning more for the owners. The management of this firm were dissatisfied with their profits. They were not doing badly, but having regard to prevailing commercial conditions, to the profits of other firms in the same industry, and to their own past record, they felt that they ought to be doing better. They were attracted to the idea that profits could be planned and they had taken the advice of consultants in this art.

If a firm wants to increase its profits it must look at both prices and costs. It is generally assumed that in a sellers' market producers need not worry much about their costs; if costs are rising the productivity of the business can be sustained by raising prices. But from the standpoint of the social economy productivity is to be measured in terms of output and cost. What conditions, then, will induce producers to reduce costs rather than raise prices and so increase productivity in the social sense?

Competition is obviously an important factor, and the position of the manufacturer in the organization of the trade is another. For instance we are now studying a firm which sells to a chain store concern whose policy is big sales at low prices. Here the price is given and if the manufacturer is to make a satisfactory profit he must look to his costs. He cannot help being cost-conscious.

But the influences that produced this attitude in our printing firm are less obvious. The pressure of competition certainly played some part. There are always firms trying to increase their share of the market or to break into what are for them new markets. We know that in some lines our firm was on the defensive; we also know that they were themselves trying to break into new markets. But the shortage of skilled labour and the ever-increasing demand for the product, together with the general effects of continued inflation, have favoured the seller in their industry. The nature of the product and of the relationship between supplier and customer also tend to favour the seller. In some lines and with some customers the firm could rely on the strength of goodwill, deriving from their reputation

for quality, for exact interpretation of customers' requirements, for reliable delivery and so on. Thus it would have been feasible to seek an improvement in profits by raising prices, at least over a considerable range of output.

Nevertheless, the emphasis in the last two years, especially, has been on cost reduction. The management were already concerned about the rise in labour costs when our investigation began; we felt that the management regarded it as in some sense a challenge to its own standards of efficiency. The very fact that costs were rising seemed to have heightened cost-consciousness. Then again the management is concerned about its standing in the trade. In conferences and committees and in less formal ways the more active employers are brought together for the exchange of ideas and experience. The printing industry sent out two productivity teams to the U.S.A. and their reports have been widely discussed. All this provides opportunities for enterprising managements to learn from others and in turn to win the approbation and respect of their fellows for their own contribution to progress. And there is the inherent interest of the job itself. In a firm such as this with many technical specialists and skilled craftsmen, a varied plant and a wide range of products, the problems of internal administration as we observed and discussed them during our investigation are both fascinating and challenging.

There was a general impression in the firm that the productivity of labour was lower than before the war. The starting point of our investigation, therefore, was an attempt to measure changes in productivity over the period by reference to the changing proportion of labour costs in the total costs of production.[3] An examination of the order books showed that there had been little change in the nature of production; but price changes had to be allowed for. Materials and manufacturing wages were the main items of cost. Materials cost was adjusted by means of an index constructed from information supplied by the firm's buying office, and for manufacturing wages we used an index made up from the wage records of employees. For adjusting the items of overhead costs the Board of Trade wholesale price index was used. This is admittedly a very rough measure of the items included in the firm's overhead costs, but having regard to the fact that labour and materials accounted for nearly 80 per cent of total costs we felt that even a fair margin of error in deflating the overheads could not seriously invalidate the results.

[3] The form in which the accounts were kept made it impossible to analyse the whole of the firm's output in this way. The departments for which total costs could be analysed produced about two-thirds of the firm's output.

Our analysis on these lines showed that there had been, since the war, a powerful upswing in the cost of labour input as a proportion of total costs. In the years 1930 to 1938 labour costs varied little around an average of 25.5 per cent of total departmental costs. For the period 1946 to 1952 the corresponding average was 40.8 per cent, when all values had been deflated in the manner described.

The necessity for this deflation should perhaps be emphasized. It might be suggested that the increased proportion of labour cost was due to labour having secured a larger share of the product through forcing up wage rates when labour has been in a strong bargaining position. Wage rates had, of course, risen substantially, but the accounts showed that the amount paid to labour was only a slightly higher proportion of the value of the product than before the war, averaging 28.2 per cent. By deflating all the values of post-war costs it is possible to show what the present labour input would have cost at the wage levels of 1930 and to relate this to total costs at 1930 values. The post-war figure of 40.8 per cent compared with the pre-war figure of 25.5 per cent is thus a measure of the increased input of labour that is required for a given physical output. In other words it is a measure of the decline in labour productivity. Owing to the nature of the data and the rather crude methods that had to be used in adjusting post-war to pre-war values the estimate of the decline cannot be at all exact. But only a very big error in the calculations and all in the same direction could invalidate the conclusion that labour productivity had declined.

Having established the fact of a decline in labour productivity by reference to the trend of labour costs, attention was turned to the use of labour and machines in the processes where the major part of production costs are incurred. The data for this part of the investigation were obtained from the cost records, which, so far as labour costs are concerned, are made up from the daily time dockets giving particulars of the order on which the operative is working, the amount of preparation and running time, delay time (with reasons for delay) and the quantity of work produced.

Comparison was again made between post-war and pre-war conditions and the general conclusion was that the productive use of machines had declined. This was due partly to an increase in standing time when there was no work for particular machines or no operative to work them — a reflection of labour shortage and of the difficulty of matching orders to plant capacity. But there was also an increase in the proportion of make-ready to running time and a decline in runs per running hour. The proportion of make-ready to running time depends partly, of course, on the size of orders

and the batches of particular orders that are run off. But examination of a large sample of pre-war and post-war orders showed no trend towards smaller orders and the length of runs seemed to be at least as favourable to productivity as before the war.

It might be objected that time-sheets are an unreliable guide to the use of machine and labour time. It is true that time-sheets exact in every detail can hardly be expected. The management might be shocked to receive such a document! Some 'cooking' is inevitable. If a worker has a good run or finishes his make-ready in less than the expected time he will keep something in hand to set against a job that takes longer than the expected time or against those occasions when, for various reasons, he is not doing anything productive. It is, however, the recorded time, whether accurate or not, that affects the costs of production as shown in the firm's accounts. This is not to suggest that there is no scope for improvement in the accuracy of factory records. We believe that much could be done with the co-operation of foremen and that this should be encouraged by giving foremen a better understanding of the importance of accountancy in the efficient running of a business.

The records based on time-sheets applied directly only to the machine rooms. But since the content of production had changed little since before the war the number of machine runs provided a measure of output for all the production departments, which when related to employment figures enables us to compare post-war and pre-war output per head. We found an all-round decline in productivity, corresponding with the increase in the proportion of labour costs; and the decline was greatest in the finishing sections, which use mainly semi-skilled female labour.

II

At an early stage in the investigation we presented the basic facts about productivity in the firm at a meeting of the Works Advisory Committee and we were asked by one of the workers' representatives if we expected to 'pin point' the cause of the trouble. We did not think so at the time and further inquiries, including the interviewing of managers, foremen and operatives, revealed the complexity of the problem. It was not hard to discover reasons for the decline in productivity; the difficulty was to determine the relative importance of the factors involved.

The higher management inclined to the view that there had been a slackening of the workers' effort since before the war. If this was so it was not due to any marked change in the age structure of the labour

force, nor to serious absenteeism or labour turnover. In the opinion of management it was the effect of full employment on the attitude to work.

The foremen and women supervisors, who knew their workers and had been brought up in the trade, were less inclined to blame the operatives. They may perhaps be reluctant to admit that slackness exists because that might be a reflection on their own efficiency. The foremen did, however, emphasize the difficulty of getting and retaining fully skilled, versatile craftsmen who would accept responsibility. This was in contrast with pre-war days when the firm could select its labour and hope to retain craftsmen whom it had trained for its own class of work. But, as they saw it, the chief cause of inefficiency was in the relations between departments. The flow of work was liable to seemingly arbitrary interruption and diversion. Instructions, they said, often showed a deplorable ignorance of working conditions on the shop floor. There were doubtless faults on both sides, for craftsmen are always inclined to be contemptuous of people without practical knowledge, often to be seen, as they say, 'walking about with bits of paper in their hands'.

What we have here is a problem of communications. Although our firm is not really big, it is big enough for this problem to show itself. The incidents recounted to us may have gained something in the telling and we were not always able to see the other side of the picture. But neither were those who were presenting it to us. We were left in no doubt that an improvement in communications can have a powerful effect on productivity.

With the workers the direct approach to the discussion of productivity problems yielded little. This was especially true of the women; productivity and the national economic situation were beyond the horizon of their interests; they could not see how such matters could be influenced by themselves. We were not surprised at this, but it was perhaps a little depressing to discover that after all the publicity and exhortation the very word 'productivity' had so little meaning for these people, who were probably somewhat above the average level of women factory workers. The men, especially the skilled men, were better informed and had a more responsible attitude. But their main interests were wages, working conditions and, in some cases, prospects of promotion.

Where direct references were made to productivity we detected a note of self-criticism in some of the observations. One man who had read the productivity reports declared that few workers applied the fact to their own case. Several felt that working conditions were too easy and that there was a good deal of slack to be taken up. We

found evidence of conventional rates of output, which some workers realized were well below their capacity.

But, as might be expected, much of the criticism was directed at other people and especially those in other departments. There were too many office people, who had to be carried by the 'productive' workers.[4] Worse still were the people who 'interfered' with production: the 'planning and palaver people', as one man called them, who were 'always getting under your feet'. Opinions on top management varied a good deal. There were frequent references to their aloofness, an attitude resented by some but to others not unwelcome. A few had specific criticisms, with reference to investment policy for instance.

Yet on the whole this was a happy firm. Much of the criticism we heard was in its way constructive. Some of the workers' observations were no doubt the product of misunderstanding or ignorance of all the factors involved. But the people who made them were not indifferent to the firm's welfare nor entirely unconcerned about productivity. It is perhaps not always realized that employees, especially men with long service, often take a lively and even passionate interest in what they regard as 'our firm'. We found plenty of evidence of this — a fund of good will, and much of the criticism we heard was really an expression of regret that the fund was so seldom drawn upon.

Some see the remedy for this state of affairs in the development of joint consultation. The firm has a joint Works Advisory Committee, but we found no enthusiasm for it; some workers were even unaware of its existence. Far more effective, if limited in scope, is the organization which trade unionism has introduced and which serves for both consultation and negotiation. The installation of the incentive scheme provides a good illustration of this. We were told by critics of the Works Advisory Committee that the Incentives Committee was working well. And a trade union official said that one of the reasons for their acceptance of incentive schemes was in the arrangements for joint consultation that were attached to them. These gave the union members and officials the opportunity for joint consultation at the points that mattered and in the form in which, they believed, it could be most effective.

III

The incentive scheme just referred to was part of an all-round effort to increase productivity. A bonus scheme was already in

[4] The office staff was 16 per cent of total factory operatives in 1937 and 19 per cent of a larger total in 1953. But there was more office work than before the war; e.g. the firm now did its own financial accounts and the wage incentive scheme required an office staff.

operation in one small department before our investigation began. When it was extended to a bigger department we were able to study the experiment from its inception and to observe the effects, not merely in the department immediately concerned, but throughout the organization of the firm. The nature and extent of these repercussions were not clearly foreseen and much of the trouble that arose later on was due to this. Within the limits of the scheme itself, however, the preparatory work was undoubtedly well done.

The first step was to get the workers' consent to a system of payment by results. Our inquiries in this firm and in firms where piece rates are the rule show that many workers are well aware of the disadvantages of such systems, even where the method of rate fixing is accepted as fair. Many dislike the inevitable fluctuations in earnings: some, apparently, feel themselves under pressure and subject to external controls, which diminishes their satisfaction in work; others who have had experience of both time and piece rates sense a deterioration in personal relationships under the latter system: too much concern with money, they say, makes a harsher atmosphere, there is jealous watching of one another, bickering and sometimes favouritism. In the case now described it took the workers three years, even with the example of a bonus scheme already operating in another section, to decide in favour of the extension of the scheme to their department.

The scheme was introduced by outside specialists. Its principles are fairly simple and well known to those familiar with the various systems of payment by results. All productive work is measured in standard minutes and a bonus is paid as a percentage on the time rate for work exceeding the basic performance. The chief task is to determine the basic performance, which assumes a normal speed of working, a normal method and normal conditions in other respects. Much harm has been done by the exaggerated claims of some time-study specialists for the scientific validity of their work. It is surely better to recognize that there is an element of subjective valuation in time study and to see that adequate safeguards of the workers' interests are provided. This was an essential feature of the scheme as we observed it. There was consultation at every stage through a representative chosen by the workers: in the determination of the elements, in the timing, in the assessment of the normal as regards speed and method. Later the working of the scheme was frequently reviewed by a joint committee of workers and management and either side has the right to terminate the scheme on three months' notice.

In both sections where they applied, the bonus schemes had a marked effect on output, which increased by one-third in the first section and by nearly two-thirds in the second and bigger section. The increase in earnings averaged 10d. an hour for skilled men and 7d. an hour for semi-skilled women. As was to be expected the bonus varied considerably from worker to worker; but it was surprising to discover that the range of variation was greater for the semi-skilled workers. There were also wide differences between the highest and lowest hourly bonus earnings of individual workers. One reason for this was in the failure to achieve uniformity in the pricing of jobs; in spite of all the care devoted to job analysis and time study there were still good and bad jobs, and one of the most harassing tasks of the foremen was to see that each worker got a fair share of the good jobs.

The bonus provided the incentive and physical productivity increased. But how exactly was this result achieved? There was no spectacular speeding-up, though there was less late starting and early stopping of work and there was steadier application to the job. Thus the scheme had the direct effect of keeping the worker on the job. But the indirect effect was more important; workers were now quick to complain if they were kept waiting for jobs or for materials, or for the foreman's approval or for machine adjustments. It was impressed upon us that the incentive scheme produced its results largely through its effects on management. And these were by no means confined to the production departments. As has been said, there were repercussions throughout the firm's organization. In the effort to standardize jobs much of the preparatory work formerly done by machine operatives was transferred to a specialized section. The methods of the order office from which instructions were received had to be improved. The sales department was involved in several ways; it had to understand that customers' requirements must be ascertained exactly and that changes in orders should not be made once work was in progress; it had to find outlets for the increased production and it had to direct its efforts with due regard to the planning of production.

Thus the incentive scheme produced its results largely through its effect on management. But the pressure came from the workers whose earnings were dependent on output. Management by introducing the bonus scheme and improving the organization of work provided the opportunity for labour to increase its output. But since processes did not change much, this increased output did mean more effort on the workers' part.

IV

This sounds like the happy ending of a success story. But there was still one important question to be answered: had the scheme paid? To some members of the management the answer was obvious. Productivity was up, just as the consultants promised; indeed, the results were even better than the forecast. Was not this sufficient proof? But when we put our question to the accountant we found him less enthusiastic.

Briefly, his calculations showed that the increased output should have brought a substantial gain to the firm through additional recovery of overheads. But there had to be set against this (1) the cost of the workers' bonus earnings, (2) the cost of staff required to operate the scheme and (3) a proportion of the cost of installing the scheme treated as a capital investment. The last two items amounted to about 40 per cent of the cost of securing the increased output, and the three items together halved the potential saving on overheads. However, enough of the saving remained to enable the firm to show a fairly good profit on work done under the incentive scheme. To sell the increased output, prices had to be trimmed or classes of work accepted for which the customary margin was narrow. This came out in the turnover figures. But without the scheme, profit would have been much less, because of the smaller amount of work done, even at the previous level of prices.

So the scheme had been financially successful. But its success should have been much greater. The potential profit, or 'standard' profit as the firm calls it, is the difference between total sales revenue at quoted prices and total estimated costs. The actual profit was only 38 per cent of the standard; and the main reason for this disappointing result was in the discrepancy between estimated and actual labour costs measured in so-called productive standard minutes. In theory every job is a combination of basic elements the timings and work values for which are known and accepted, but in estimating the number of standard minutes required for a job a standard method must be assumed. If the prescribed combination for a particular job proves impracticable, either because the work is not delivered in the required form, or because unforeseen snags occur after the job begins, or simply because the operative complains and his complaint is upheld by the foreman, there is a departure from the standard. The technical causes of variation from the standard are the less difficult side of the problem, which is ultimately the problem of securing the co-operation of operatives in working to standard methods. The worker is primarily concerned with the number of standard minutes he can record; it is for management to ensure that

the standard minutes recorded and paid for are really productive in terms of work value.

Wage incentive schemes are no substitute for good management. In some ways, as this experience proves, they increase the responsibilities of management at all levels and particularly at the departmental level. It is here that consideration should be given to the provision of adequate financial incentives and also to the recognition of status commensurate with responsibility.

V

But the importance of the bonus scheme in the economy of this firm must not be exaggerated. It applies only to a minority of the production workers. In one section there is union opposition to incentive schemes and in others the nature of the work is unsuitable. Here efforts have been made to increase productivity by work study. Among the women workers where this has mainly been applied we found a fairly ready acceptance of new methods and indeed of any change that improved the flow of work without adding to effort. Improved methods can often be introduced very economically, and experience of what can thus be achieved has convinced some members of the firm that the problem of increasing productivity should be approached this way rather than through wage incentives. All the improvements in organization that accompanied the introduction of incentive schemes, they point out, could have been made in any case. The workers' co-operation could have been secured by improving supervision and raising time rates, though the latter course might have aroused criticism from other members of the industry. One large firm which we know well has achieved good results through work study alone; though much of its work is very suitable for payment by results the firm does not believe that any further gain would be secured by this means.

The improvement of methods is of course often accompanied by the installation of new equipment; it may depend on this. In our firm few important changes in equipment have been made since the war. It must be remembered that there was already considerable unused capacity, which was partly a reflection of labour shortage. Moreover, the possibility of economizing skilled labour by introducing more automatic or more specialized machinery was limited by trade union restrictions. Thus the emphasis has been on using the existing equipment and labour force more effectively. But the improvement of methods is not to be looked for only on the shop floor. Improvements in administration may be of primary importance. For instance there is the problem of communications already

mentioned. Accountancy may be regarded as part of the system of communications, and one of the best things this firm has done in recent years is to reform its methods of accounting. It was only three years ago, following changes in the top management,[6] that the firm began to use accountancy as a guide to policy and as an instrument of control. The former management, we were told, knew how to make a profit 'by instinct'. They were highly competent on the technical side and apparently carried the essential information for running the business in their heads. If things seemed to be going wrong they went down into the departments themselves and saw that they were put right. These were the conditions that workers remembered when they referred to the 'aloofness' of the present management. But the business was already growing beyond the size at which it could be effectively controlled in this way even by men who had spent their working lives in it. In any case the new management had to have their information on paper.

The system of management accounting, which was installed by consultants, is well designed to provide the required information and it is remarkably economical in operation having regard to the potential benefits to be derived from it. But it is not sufficient to buy and install the methods of administrative control. Just as new mechanical equipment may require workers to be trained in its use and may arouse opposition from people whose interests seem to be adversely affected, so with the machinery of administration. No system works by itself; it is only as effective as individuals make it. One of the accountant's main difficulties has been to secure the active interest of people in what he is trying to do. 'People here', he complained, 'are not figure conscious and measuring the cost of output is not of great interest either to workers or the general run of management.' Yet the effective use of resources depends on accurate knowledge, speedily recorded, given significance by expert interpretation and acted upon. To provide the facts is largely the responsibility of management at departmental level; action is the responsibility of top management. At both levels, we found, much still needed to be done before the potential value of management accounting as an aid to productivity could be fully realized.

VI

The approach to the study of productivity problems which is here described has its disadvantages. So far we have found no difficulty in securing the co-operation of firms: but the work of analysing

[6] These did not involve a complete break with the past and there was no change in the ownership of the firm.

records and adapting them to one's purpose is apt to be slow and laborious. And of course not all the facts can be ascertained in this way; much has to be learned by questioning and discussion and one often has to be content with a general impression. Moreover, every firm is in some sense unique — they sometimes emphasize this themselves — and one must beware of generalizing too freely. But the conditions of national productivity are ultimately determined in individual firms. They operate within the general economic and social framework. In many ways they are controlled rather than controlling. But every firm is itself an economic unit — an organization for administering scarce resources — and also a social unit — a pattern of human relationships. Upon the quality of the leadership and the effectiveness of co-operation at this level the welfare of the whole social economy ultimately depends.

THE UNIVERSITY OF NOTTINGHAM

SCALE, COSTS AND PROFITABILITY IN ROAD PASSENGER TRANSPORT[1]

by J. JOHNSTON

I

THE theoretical analysis of the relationship between costs and output in economics has usually been simplified by concentrating, in the main, upon two extreme positions:

(*a*) The short-run situation, where a plant's equipment and capacity are taken as fixed and variations in output are achieved by varying the inputs of labour, materials and power, and

(*b*) The long-run situation, where it is assumed that the inputs of *all* productive factors can be freely adjusted to achieve the optimal (least cost) combinations for various output levels.

These situations produce two distinct sets of cost-output relationships, and certain assumptions about their form constitute one of the foundation stones of any theory of price formation. A method of testing various hypotheses about the nature of cost-output relationships is to subject empirical data produced by the actual functioning of the economic system to statistical analysis. This procedure often raises difficult accounting and statistical problems of adapting the data provided by firms' records to suit the requirements of the study and of employing a method of statistical estimation which is consistent with the economic model, which is presumed to have generated the observations. Illustrations of these problems are given below. A useful by-product of the method is that statistically derived cost-output relationships can be made to provide an experimental check on the hypotheses underlying cost estimates made by the accountants and others.

This article presents the results of a statistical investigation of the relationship between output and costs in a single road passenger transport firm over a period of time and of the relationship between scale, costs and profitability in a cross section of firms at a given period of time. Time series data on costs and output are also available for the cross section of firms so that it is possible to picture graphically a group of short-run cost curves for firms of different sizes.

[1] The information on which this article is based was collected under a research grant from the Houblon-Norman Fund. The author also wishes to acknowledge his indebtedness to the officials of the firms studied for their generous co-operation. Other articles by the author in the same series are: 'Statistical Cost Functions in Electricity Supply', *Oxford Economic Papers*, 1952; 'Cost-Output Variations in a Multiple Product Firm', *The Manchester School*, 1953; 'Labour Productivity and Size of Establishment', *Bulletin of the Oxford Institute of Statistics*, 1954.

Since the analysis which follows is necessarily statistical we give here the summary of the main results. For the single firm which was examined in detail it appeared that there was a straight line relationship between total expenses and car miles, especially when allowance had been made for extraneous factors such as variations in the prices of materials and in wage-rates. An estimate of the relationship, based on the data given in Table I of the Appendix, was (Total Deflated Expenses) = £65,580+0.04433 (Car Miles). The meaning of this relationship is that a variation of 100 car miles in this undertaking caused, on the average, a corresponding variation of £4.433 in total expenses. Or looking at the relationship in percentage terms, a 10 per cent increase, say, in car miles was associated with an increase of approximately 7 per cent in total expenses, which corresponds to about a 3 per cent decrease in average expenses per car mile.

The second part of the investigation was based on statistical and accounting data for twenty-four companies of different size, given in Table II of the Appendix. This made it possible to examine how average costs were in fact influenced by other factors such as the percentage of the fleet on fuel oil and the percentage of double deckers, but when allowance was made for these factors average costs declined slightly, on the average, as size of company increased.

Finally we examined the influence of size of company and related factors on profits and it appeared that profits per car mile were, on the average, somewhat lower in the larger companies.

II

The firm for which we have detailed information is one of the larger undertakings in the country with an operating staff of about 3500 and a fleet of over 1300 vehicles, which supply about 45 million car miles of transport each year. The bulk of the firm's activity consists of the provision of ordinary stage and express services on which about 190 million passenger journeys are made each year; in addition there are some tours and special contract services. These activities bring in a gross revenue of about £3¾ million annually.

For planning and accounting purposes the year is divided into thirteen four-week periods and most of the important statistics for these periods show a very marked seasonal pattern. Graph A, for example, shows the behaviour of three basic statistics over the years 1949-52; the first series, car miles per period, displays a very regular seasonal movement with a maximum in the eighth period and a minimum in the thirteenth period each year. Receipts per car mile

show an equally strong seasonal pattern, but the outline is not quite so smooth and the series also shows an upward trend, as a general increase in fares took effect at the beginning of 1951 and a selective increase in August of that year. Thus not only does the undertaking provide more car miles in the summer but these car miles make a greater average contribution to revenue than do those of the winter months. Total expenses per car mile display a reverse, though weaker seasonal pattern, the higher degree of utilization of equipment and staff in the summer months leading to a reduction in unit costs. If the graph of receipts per car mile were superimposed on that of expenses, the two would intersect to give a 'scissors' effect, showing profits being earned in the summer and losses incurred in the winter. This allocation of the year's total profit between the constituent four-week periods is arbitrary, in that it depends on the spread of the year's fixed costs over these periods, and it is quite possible that the application of a different principle for spreading the fixed costs could eliminate the losses of the winter, reduce the profits of the summer and leave the year's net profit unchanged.

In the same sense, of course, any given year's profit is arbitrary, depending upon the method employed to assess the cost of the current services of the firm's land, buildings and equipment. This arbitrary element in costing is unavoidable, and a statistical cost-output relationship only has meaning in relation to the underlying pattern of fixed cost allocation. The importance of this arbitrary element in the present context depends upon the relative size of the expense items affected by it, and so we must look at the composition of the figure for total expenses per period.

Table I shows the break-down of the total expenses figure and the relative importance of the various components, based on data for the year 1951.

TABLE I

Percentage Composition of Total Expenses, 1951

	Cost Category	*Percentage of Total*
A.	Vehicle Operating	62
B.	Maintenance and Depreciation (Vehicles, plant and equipment)	20
C.	Other Traffic Costs	10
D.	Maintenance and Renewal of Structures	2
E.	Vehicle Licences	3
F.	General Expenses	3

Vehicle operating expenses consists of the wages, clothing and national insurance of drivers and conductors, petrol and fuel oil, tyres and lubricants. This is the largest and most important element of cost and fortunately presents no real problem of arbitrary allocation. The cost of all items except tyres is directly related to current inputs of labour and materials and is readily ascertainable: the cost figures for tyres is obtained for each period by applying a fixed rate of expense to the period's actual mileage; in the period studied this rate was fixed anew each quarter to allow for the frequent rises in the purchase price of new tyres, which by mid-1952 were costing two-thirds as much again as at the commencement of 1949.

In category B the bulk of the expenditure is accounted for by vehicle maintenance and depreciation. Vehicle maintenance, which consists of expenditure on labour and materials in about the ratio of two to one, varies fairly directly with car miles and vehicle depreciation is charged on a strict mileage basis, on the assumption of a twelve-year life for a bus chassis and a six-year life for the body. The recorded figures for maintenance of plant and equipment fluctuate from period to period in a rather arbitrary fashion without showing any relationship to car miles. A fixed charge was made each period for plant and equipment depreciation, and it might reasonably be argued that the maintenance and depreciation for plant and equipment should be excluded from the cost figures. We did not trouble to do this as both figures account for only about $\frac{1}{2}$ per cent of total expenditure.

Other traffic costs consist of the wages, etc., of traffic staff, bus cleaning, tickets, miscellaneous expense such as the cost of tolls, and finally compensation and insurance of vehicles. These cost items are in the main directly influenced by the number of car miles run per period, and we include them all in the total expenses figure.

The maintenance and renewal of structures is a cost item which bears no direct relation to current car miles, the figures recorded for each period being the expenses actually incurred in the four weeks and not some arbitrary allocation of the year's estimated total expenditure. Vehicle licences may be taken out for as short a period as a month, and so this cost item is fairly directly related to current output. The final item of General Expenses is a grouping of such items as salaries, office expenses, rent, rates, publicity and insurance. These are approximately constant from period to period and account for about 3 per cent of total expenses.

Cost categories A, B and C thus account for over 90 per cent of total expenses and are in the main composed of items which are directly related to current output. We accepted, therefore, the total

recorded figures of cost in each four-week period as the basis of our analysis, subject to deflation for factor price changes. For this purpose we constructed separate price indices from the firm's records for Wages, Fuel, and Tyres (in Category A), for Maintenance and Depreciation[1] (B), Other Traffic Costs (C), and Maintenance and Renewal of Structures (D). The rate of licence duty did not change during the period studied, and the collection of cost items under General Expenses (F) was so miscellaneous that, in view of its small percentage share in the total expenses and the more stable behaviour of prices in this group, we did not adjust for price changes in this group.

Sections (I) to (IV) of Graph B illustrate the relation of the more important items of deflated cost to car miles. For both Wages and Fuel Costs the relationship is seen to be strong and linear. The adjustment of the recorded fuel costs was made as follows. Since fuel costs are, by definition, equal to total mileage multiplied by the price per gallon and divided by mileage per gallon (m.p.g.) the correction we require is given by:

$$(1)\quad \text{Corrected fuel cost} = \text{Observed fuel costs} \times \frac{(\text{m.p.g.})}{(\text{price per gallon})}$$

That is, we adjust the observed costs not only for price changes, but also for changes in the efficiency of utilization of fuel as measured by m.p.g. This latter factor would be influenced by changes in the quality of the fuel supplied or by changes in the type of bus, etc. The situation was further complicated by the use of two types of fuel, namely fuel oil and motor spirit, and by a steady shift from the latter to the former throughout the period studied. Thus for the correction defined by (1) above, we require to use *average* m.p.g. and *average* price per gallon, where the averages are taken over both fuels in each four-week period. The resultant deflated fuel costs display a strong linear relationship with car miles. As might be expected the relationship of Maintenance and Depreciation to car miles is less strong. But there is a suggestion that it is positive and linear. Other Traffic Costs also increase fairly steadily with output and the overall result, as shown in the final section of Graph B, is a fairly strong linear relationship between total expenses and output.

We now proceed to estimate the parameters of this cost-output relationship from the data given in Table I of the Appendix. In

[1] This index was constructed by combining with appropriate weights a price index of the materials used and a wage rate index based on the rates for electricians, engineers, greasers and bodybuilders. This index applies specifically to maintenance expenditure, which constitutes about two-thirds of expenditure in Group B, but it was used to deflate the total expenditure in this group, on the assumption that replacement prices would be fairly closely related to the prices of the materials and labour involved.

this transport undertaking car miles was a basic decision variable. Towards the end of each year the car mile budget was laid down for the thirteen forthcoming periods, largely by duplicating the marked seasonal pattern of the current year. There existed, however, some flexibility in the adjustment of car miles actually supplied to changing conditions and variations in local needs. Thus the above decision-taking procedure may be described by the relation:

$$(2)\quad x_t = \alpha_0 + \alpha_1\ x_{t-13} + u_t$$

which states that car miles run in period t (x_t) are equal to a linear function of the car miles run in the corresponding period of the previous year plus a disturbance term (u_t). The graph of car miles in the first section of Graph A shows that we may expect α_0 to be close to zero and α_1 close to unity.

If y_t represents total deflated costs in period then the cost function may be written:

$$(3)\quad y_t = \beta_0 + \beta_1 x_t + v_t$$

where v_t represents a disturbance term. The procedure followed in the statistical estimation of the β's now depends upon the assumptions made about the disturbances u and v. If one assumes that u_t and v_t follow a joint normal distribution with zero means, unknown but constant variances and zero covariance and if in addition the u, v values are serially independent, then it would follow that the straightforward application of least squares to y_t and x_t would yield maximum-likelihood estimates of the β's.[3] The application of least-squares methods to (2) and (3) separately, with thirty-three pairs of observations in each case, gives:

$$(4)\quad x_t = -0.1969 + 1.0643\ x_{t-13} + u_t$$
$$r = 0.9888$$
$$d = \frac{\Sigma(\Delta u)^2}{\Sigma u^2} = 1.0067$$

and

$$(5)\quad y_t = 0.6497 + 0.4467\ x_t + v_t$$
$$r = 0.9729$$
$$d = \frac{\Sigma(\Delta v)^2}{\Sigma v^2} = 1.1585$$

The correlation between the u,v residuals is $r_{uv} = 0.1595$, so that the assumption of independence between the two disturbances

[3] For a most lucid exposition of estimation problems in econometrics see L. R. Klein, *A Textbook of Econometrics*, chap. III.

seems a reasonable one, but the d values, on reference to the significance points tabulated by Durbin and Watson,[4] indicate significant positive serial correlation at 1 per cent level in each set of residuals. This is a fairly common situation in econometric work and it is customary to attempt to resolve it by taking first differences of the original observations, before carrying out the statistical computations. This is equivalent to assuming that the autoregressive structure of the disturbance term is represented to a sufficient degree of approximation by:

$$(6)\quad u_t = u_{t-1} + \varepsilon_t$$

where ε_t is independent over time. For small ε this implies a very high positive value for the first autocorrelation of the u's. As an alternative we assumed an autoregressive structure for both the u's and v's of the form:

$$(7)\quad u_t = 0.5\, u_{t-1} + \varepsilon_t$$

and thus transformed each of the three variables y_t, x_t, and x_{t-1}, by means of:

$$(1 - 0.5\, E^{-1})$$

where E^{-1} denotes the preceding value of a variable. Applying least-squares to the transformed variables we obtained the following estimates of the α's and β's:

$$(8)\quad a_0 = -0.2016,\ a_1 = 1.0650,\ r = 0.9811,\ d = 2.0837$$
$$(9)\quad b_0 = 0.6558,\ b_1 = 0.4433,\ r = 0.9536,\ d = 2.7709$$

The correlation coefficient between the residuals in the analysis based on transformed variables is 0.1231. Thus the transformed variables more nearly satisfy the assumptions underlying least-squares statistical procedure: the first value of d gives no indication of serial correlation of the residuals, the second value gives a significant indication of negative serial correlation at the 5 per cent but not at the 1 per cent level, and the correlation between the two sets of residuals is very low.

Comparing (4) and (5) with (8) and (9) it will be seen that the estimates of regression and correlation coefficients come out very close together for the untransformed and transformed data. We take as our estimates of the parameters of the total cost function the results given in (9), and the resultant straight line is shown in Section (v) of Graph B. For values of car miles ranging from 3.2 to 4.0 million, the elasticity of this total cost function ranges from 0.68 to

[4] Durbin and Watson, 'Testing for serial correlation in least-squares regression. II', *Biometrika* 1951, pp. 159-78.

0.73, so that we may conclude that an increase of 10 per cent in output is associated on the average with an increase of 7 per cent in total costs. The short-run *average* cost function is thus downward sloping to the right throughout its length, an increase of 10 per cent in output being associated on the average with a 3 per cent reduction in average costs per unit of output.

An approximate idea of the shape of the long-run cost function is obtained from an examination of cross-section data for a group of different sized firms at a given period of time. This tends to eliminate the influence of extraneous variables, such as prices, which vary with the passage of time, and if the variations in plant size are sufficiently great we obtain a picture of how cost varies over a wide output range. Data collected by a standard accounting procedure were made available for twenty-four firms. Graph C shows the short-run average cost curves for twenty-two different undertakings in the first seven four-week periods of 1952. The cost figures shown on the graph here have been deflated for factor price changes and the mean point is also shown for each undertaking: the co-ordinates of the latter are given by the mean four-week output and the simple average of the expenses per car mile figure in each of the seven periods. The points for successive periods are joined together and the general trend of each short-run cost curve is downward sloping to the right, as we have already found for the single undertaking analysed in detail above. With regard to the long-run relationship between costs and output, there is a fairly substantial dispersion in costs at any given output level, but nevertheless there does appear to be a tendency for costs to fall at first with increases in output and then to stabilize so that for outputs of 200,000 car miles or more no further economies of scale accrue.

We must now see if the cost-output relationship suggested by Graph C still remains after account is taken of any other relevant factors which vary significantly between undertakings. For this purpose we use annual data relating to 1951, given in Table II of the Appendix, so that each undertaking will have experienced the full range of the normal seasonal variation in its output, and we further assume that there were no important variations in factor prices between different undertakings.

The variables with which we work are then:

X_1 = log. (Total Expenses per Car Mile)
X_2 = log. (Car Miles)
X_3 = Percentage of Double Deckers in Fleet
X_4 = Percentage of Fleet on Fuel Oil.

Car Miles is brought into the analysis to see if there is any significant connection with expenses: the percentage of double deckers in an undertaking's fleet ranged from a minimum of 5 per cent to a maximum of 100 per cent, with an average figure of about 50 per cent, so this variable was also brought into the cost analysis: the percentage of the fleet on fuel oil may also be expected to influence expenses per car mile since all the undertakings in the group showed a higher mileage per gallon of fuel oil than per gallon of motor spirit, the overall averages being 11.8 and 8.8 miles respectively, and this advantage was not offset by any price differential, for fuel oil was in fact slightly cheaper than motor spirit in 1951.

The matrix of zero-order correlation coefficients is:

	X_1	X_2	X_3	X_4
X_1	1.0000	−0.4371	0.5774	0.0355
X_2		1.0000	−0.5287	−0.1825
X_3			1.0000	0.5512
X_4				1.0000

As expected we find a negative correlation between average expenses and car miles and a positive connection between expenses and percentage of double deckers, but the simple correlation between expenses and percentage of the fleet on fuel oil is very small and has a positive sign rather than the anticipated negative. However, these are only zero-order correlation coefficients, and crucial questions of interpretation arise: for example, we have seen that expenses are negatively related to car miles and positively related to the percentage of double deckers, but car miles are in turn negatively related to the percentage of double deckers, $r_{23} = -0.5287$; that is, the larger undertakings tended in general to have a lower percentage of double deckers in their fleets. Is then the negative relationship between average expenses and car miles due mainly to the direct influence of car miles or to the indirect effect through car miles of the third variable, percentage of double deckers? This type of question is answered by looking at the partial correlation coefficients which are:

$$r_{12.34} = -0.1406$$
$$r_{13.24} = 0.5742$$
$$r_{14.23} = -0.3977$$

Thus the simple correlation between expenses and car miles is reduced by about two-thirds when the influence of the other two determining variables is removed, and the resultant value (−0.1406), while it has a negative sign, is not significantly different from zero at

5 per cent level.[5] The correlation of expenses with percentage of double deckers, however, remains large and positive in the four variable analyses, and emerges as the strongest influence on unit costs, being significantly different from zero at the 1 per cent level. The effect of the fourth variable, percentage of fleet on fuel oil (-0.3977) also comes out quite strongly in the four variable analyses, the negative sign agreeing with theoretical expectation and the coefficient differing significantly from zero at the 5 per cent level (on a one tail test). Thus the effect of the full analysis is to reduce substantially the apparent connection between long-run costs and output indicated in Graph C, the size of the partial correlation coefficient being too small in relation to the number of observations on which it is based for us to conclude with any certainty that long-run costs decline with increasing output.[6]

Our main concern has been with the nature of the short- and long-run cost functions, but it is of interest to push the analysis one stage further and to examine the influence of these various factors on receipts per car mile, and hence on profits. Taking as our variables:

X_1 = log. (Receipts per Car Mile)
X_2 = log. (Car Miles)
X_3 = log. (Percentage of Double Deckers)

the matrix of zero-order correlations is:

	X_1	X_2	X_3
X_1	1.0000	-0.4093	0.4442
X_2		1.0000	-0.5545
X_3			1.0000

and the partials are:

$$r_{12.3} = -0.2186 \text{ and } r_{13.2} = 0.2861$$

The zero-order correlations show that receipts per car mile are negatively related to car miles and positively related to the percentage of double deckers. The latter result is to be expected, but there

[5] Some method of assessing the significance of results in this kind of analysis is required, since the data for a given year are only a sample of the observations theoretically obtainable from repeated measurement in other years. Moreover, it is usually the case that the application of the standard tests of significance is a less hazardous undertaking in cross-section than in time series analysis. It seems, however, almost a general rule in econometric work that the correlations obtained in cross section analysis are much smaller than those found in time series work, but statistically non-significant values need not be too depressing, since they would soon become significant if they were found to hold in other years, and would then lead to the rejection of the null hypothesis of no association between the variables in question.

[6] '. . . the omnibus trade conforms perhaps to the law of constant return': A. Marshall, *Principles of Economics*, 8th ed., p. 458, fn. 2.

is the question whether the correlation of −0.4093 between receipts and car miles indicates some important relationship between fare structure or passenger density (which influence receipts) and car miles on the one hand or whether it is mainly due to the fact that the larger undertakings tend to have a smaller proportion of double deckers and hence a smaller revenue per car mile. The partial correlation of −0.2186 suggests that both effects are at work, since this is about half the size of the zero-order coefficient and has the same negative sign. This interpretation is supported by the fact that the partial correlation $r_{12.3} = 0.2861$ is lower than the zero-order coefficient $r_{13} = 0.4442$ and not significantly different from zero at the 5 per cent level of significance. If the percentage of double deckers was the main factor determining the level of receipts per car mile, as we found it to be in the explanation of expenses, then we should expect its partial coefficient to remain fairly high and significantly different from zero, as in the cost analysis above.

Each of the two main variables acts in the same direction on receipts and expenses: the percentage of double deckers pushes up both receipts and expenses per car mile, while for car miles there is a weaker but negative connection in each case. It is impossible, therefore, to predict the effect of either variable on profits per car mile. For an analysis of profits we take the following variables:

X_1 = log. (Profits per Car Mile)
X_2 = log. (Car Miles)
X_3 = log. (Percentage of Double Deckers)
X_4 = log. (Percentage on Fuel Oil)
X_5 = log. (Car Miles per Car per week)

The only new variable introduced here is car miles per car per week, which reflects the intensity of vehicle use and might be expected to influence profits through costs. The matrix of zero-order correlations is:

	X_1	X_2	X_3	X_4	X_5
X_1	1.0000	−0.3204	0.1941	0.1450	−0.0168
X_2		1.0000	−0.5545	−0.1746	0.3461
X_3			1.0000	0.4614	0.0591
X_4				1.0000	0.7241
X_5					1.0000

and the partial coefficients are:

$$r_{12.345} = -0.2459$$
$$r_{13.245} = -0.0164$$
$$r_{14.235} = 0.0164$$
$$r_{15.234} = 0.0447$$

These results are largely negative in that they enable us to eliminate the factors which have no influence on profits. The strongest suggestion is that the larger undertakings have lower profits per car mile, though the correlation coefficient is not significantly different from zero at the 5 per cent level. The percentage of double deckers was found to be fairly strongly related to costs, but the positive relationship with receipts appears to have been strong enough for the two effects to break even, so that there is no significant connection between this variable and profits per car mile. Similar results hold for the variables, percentage on fuel oil and intensity of vehicle use. The failure of the last three variables to account for any significant part of the variation in profits suggests that the main explanation may lie with two variables upon which it has not yet been possible to obtain information, namely the fares structure and the passenger density in the different undertakings.

Our conclusions may be summarized:

(1) The detailed analysis of a single large undertaking with a substantial seasonal variation in output showed its short-run average cost to be a decreasing function of output over the whole of the observed output range.

(2) There was some indication that long-run average costs also decline with output, but it was not strong enough to lead to the rejection of the hypothesis that long-run average costs do not vary with output.

(3) There was also a slight indication that profits per car mile decline with size, but again it was not statistically significant.

DEPARTMENT OF ECONOMICS,
UNIVERSITY OF MANCHESTER

APPENDIX

TABLE I: VARIABLES FOR THE TIME SERIES ANALYSIS

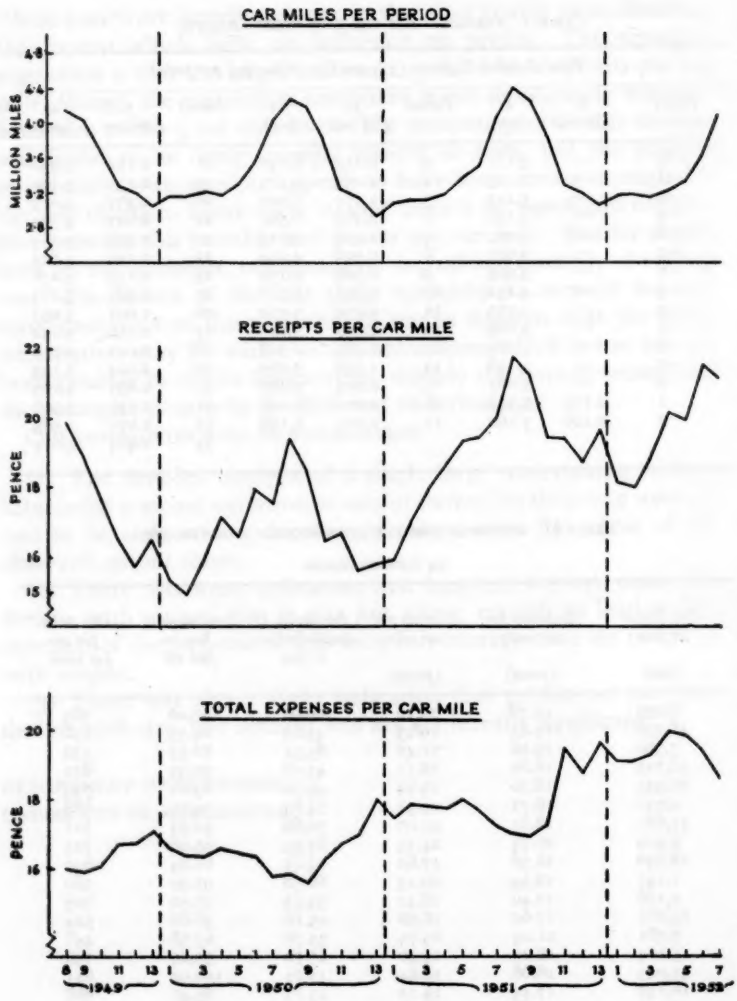
Total Deflated Expenses (y_t) and Car Miles (x_t) per period								
Period	y_t £00'000	x_t (*mn*)	*Period*	y_t £00'000	x_t (*mn*)	*Period*	y_t £00'000	x_t (*mn*)
−12	—	3.111	3	2.153	3.197	18	2.132	3.338
−11	—	3.125	4	2.153	3.173	19	2.195	3.492
−10	—	3.143	5	2.154	3.292	20	2.437	4.019
−9	—	3.136	6	2.282	3.561	21	2.623	4.394
−8	—	3.247	7	2.456	4.013	22	2.523	4.251
−7	—	3.621	8	2.599	4.244	23	2.244	3.844
−6	—	3.995	9	2.509	4.159	24	2.153	3.276
−5	—	4.151	10	2.345	3.776	25	2.025	3.184
−4	—	4.055	11	2.059	3.232	26	2.007	3.037
−3	—	3.689	12	2.027	3.141	27	2.018	3.142
−2	—	3.289	13	1.985	2.928	28	2.021	3.159
−1	—	3.196	14	1.956	3.063	29	2.004	3.139
0	—	3.061	15	2.004	3.096	30	2.093	3.203
1	2.139	3.147	16	2.001	3.096	31	2.139	3.307
2	2.126	3.160	17	2.015	3.158	32	2.270	3.585
						33	2.464	4.073

TABLE II: VARIABLES FOR THE CROSS-SECTION ANALYSIS, 1951

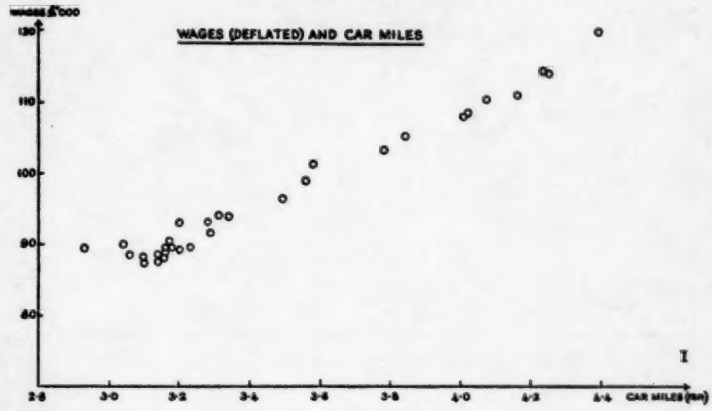
24 UNDERTAKINGS

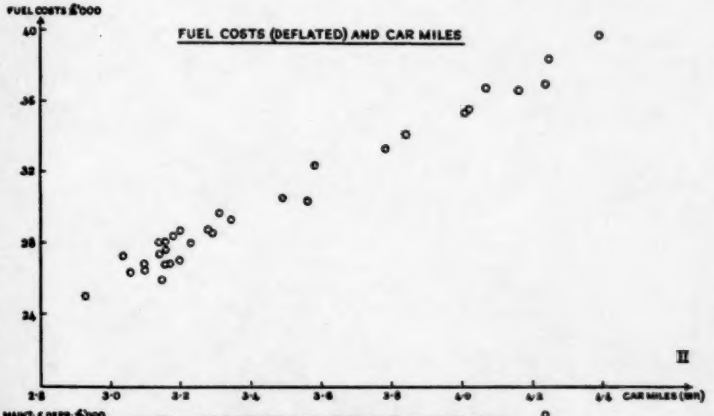
Car Miles in year (*000*)	*Expenses per car mile* (*pence*)	*Receipts per car mile* (*pence*)	*Percentage of double deckers in fleet*	*Percentage of fleet on fuel oil*	*Car miles per car per week*
6,235	19.76	25.10	100.00	100.00	785
46,230	17.85	19.23	43.67	84.53	656
7,360	19.96	21.42	65.51	81.57	578
28,715	16.80	18.11	45.16	93.33	812
21,934	18.20	19.24	49.20	83.07	733
1,337	16.71	19.31	74.84	94.99	688
17,881	18.81	20.07	70.66	92.34	711
2,319	20.74	24.35	63.93	95.08	725
18,040	16.56	17.60	14.45	61.24	642
1,147	18.55	20.13	68.58	97.90	560
2,176	17.40	18.40	53.33	97.50	709
13,267	17.62	18.96	25.16	56.86	514
3,581	21.24	25.75	35.76	63.58	448
15,104	18.23	19.40	47.72	95.29	748
47,009	16.86	18.64	17.21	100.00	841
10,139	17.45	19.10	43.15	89.40	668
6,147	17.66	20.00	67.73	92.54	686
23,089	18.30	19.31	33.27	67.53	598
20,550	16.58	20.49	26.61	98.32	800
9,450	17.51	17.07	61.35	86.72	N.A.
1,028	21.17	20.61	100.00	100.00	N.A.
3,848	16.92	15.73	5.35	65.58	N.A.
15,656	16.96	18.70	20.53	93.72	683
7,725	18.24	18.99	50.59	96.63	703

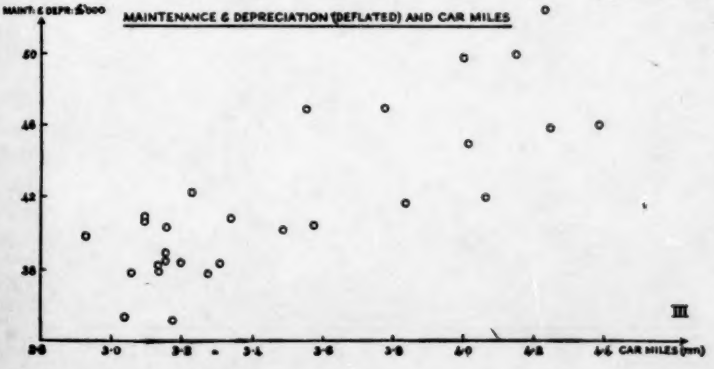
GRAPH A


CAR MILES PER PERIOD
MILLION MILES
4·8
4·4
4·0
3·6
3·2
2·8
RECEIPTS PER CAR MILE
PENCE
22
20
18
16
15
TOTAL EXPENSES PER CAR MILE
PENCE
20
18
16
5 9 11 13 1 3 5 7 9 11 13 1 3 5 7 9 11 13 1 3 5 7
1949
1950
1951
1952

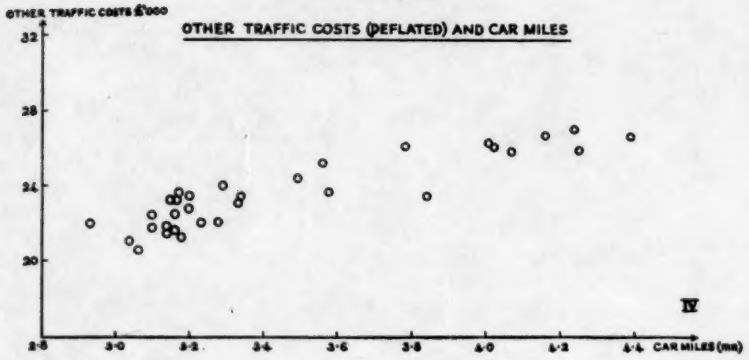
GRAPH B

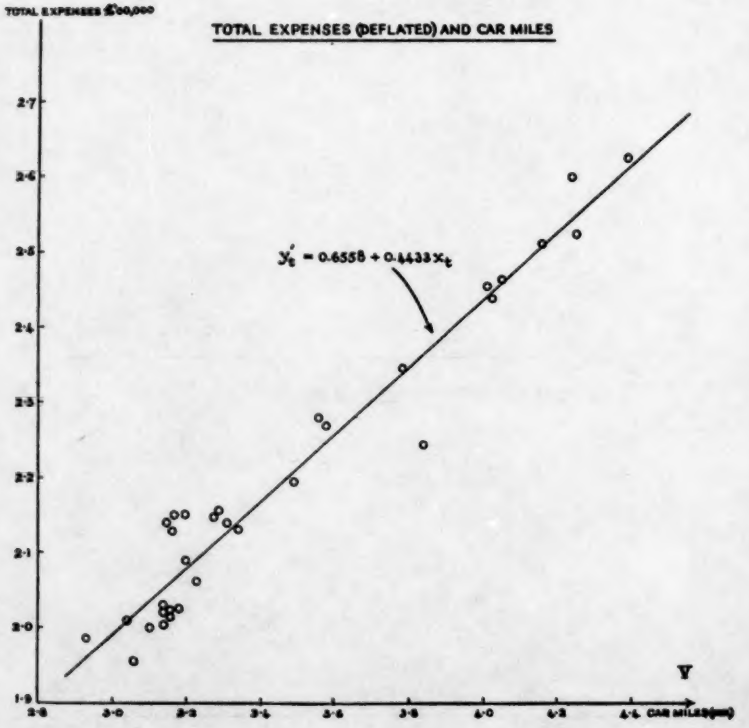

WAGES £'000
WAGES (DEFLATED) AND CAR MILES
120
110
100
90
80
I
2·8
3·0
3·2
3·4
3·6
3·8
4·0
4·2
4·4
CAR MILES (mn)


FUEL COSTS £'000
FUEL COSTS (DEFLATED) AND CAR MILES
40
36
32
28
24
II
2·8
3·0
3·2
3·4
3·6
3·8
4·0
4·2
4·4
CAR MILES (mn)

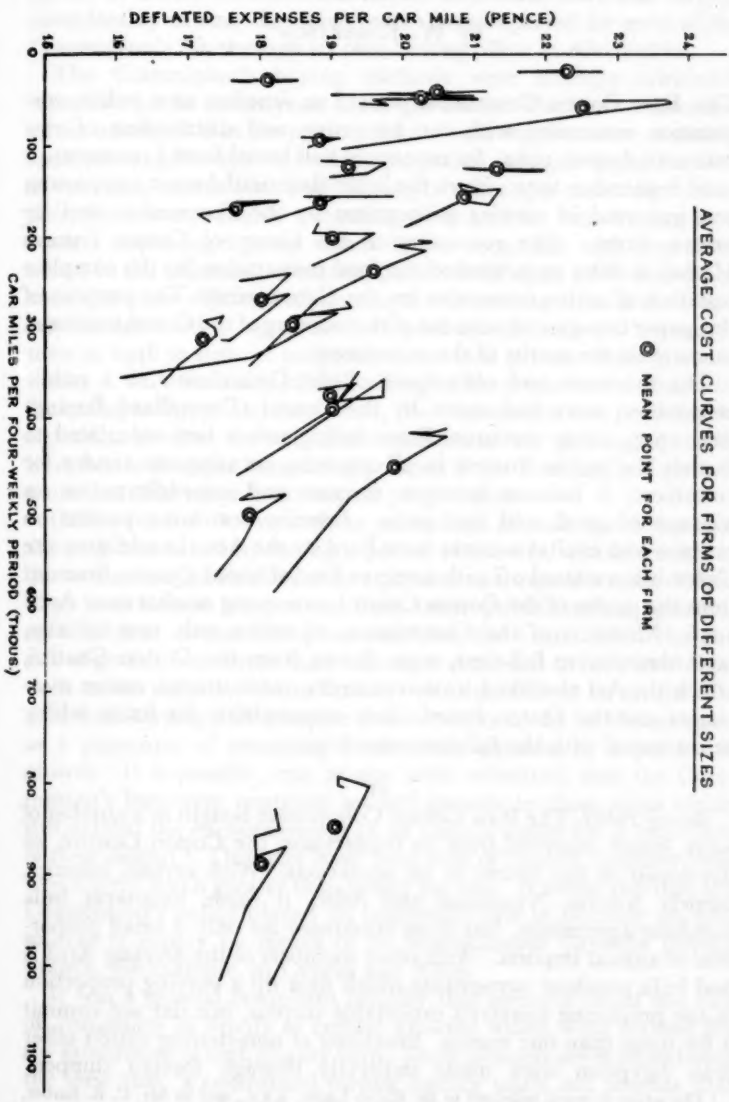

MAINT. & DEPR. £'000
MAINTENANCE & DEPRECIATION (DEFLATED) AND CAR MILES
50
46
42
38
III
3·0
3·2
3·4
3·6
3·8
4·0
4·2
4·4
CAR MILES (mn)

GRAPH B (*cont.*)


OTHER TRAFFIC COSTS £'000
OTHER TRAFFIC COSTS (DEFLATED) AND CAR MILES
32
28
24
20
IV
2·8
3·0
3·2
3·4
3·6
3·8
4·0
4·2
4·4 CAR MILES (mn)


TOTAL EXPENSES £'00,000
TOTAL EXPENSES (DEFLATED) AND CAR MILES
$y'_t = 0.6558 + 0.4433 x_t$
2·7
2·6
2·5
2·4
2·3
2·2
2·1
2·0
1·9
V
2·8
3·0
3·2
3·4
3·6
3·8
4·0
4·2
4·4 CAR MILES(mn)

GRAPH C


DEFLATED EXPENSES PER CAR MILE (PENCE)
15
16
17
18
19
20
21
22
23
24
0
100
200
300
400
500
600
700
800
900
1000
1100
CAR MILES PER FOUR-WEEKLY PERIOD (THOUS.)
AVERAGE COST CURVES FOR FIRMS OF DIFFERENT SIZES
MEAN POINT FOR EACH FIRM

THE RAW COTTON COMMISSION: AN EXPERIMENT IN STATE TRADING[1]

By W. ROBERTSON

I

THE Raw Cotton Commission ceased to function as a public corporation concerned with the importing and distribution of raw cotton in August 1954. Its monopoly had lasted from January 1948 until September 1952. From the latter date until August 1954 cotton was imported in varying proportions by the Commission and by private firms. The reopening of the Liverpool Cotton Futures Market in May 1954 marked the final preparation for the complete cessation of active operations by the Commission. The purpose of this paper is to give an account of the working of the Commission and to examine the merits of the experiment.

The functions and obligations of the Commission as a public corporation were laid down by the Cotton (Centralized Buying) Act, 1947, along the usual lines: selling prices best calculated to further the public interest in all respects; an adequate service for customers; a balance between revenue and expenditure on an average of good and bad years. Specific borrowing powers on revenue and capital account were fixed by the Act. In addition, the Commission started off with a reserve fund of about £30mn. financed from the profits of the Cotton Control on a rising market since April 1946. Members of the Commission, of whom only two initially, later three, were full-time, were drawn from the Cotton Control, which the Act abolished, cotton spinners, trade unions, cotton merchants and the Cotton Board. Sole responsibility for fixing selling prices rested with the full-time members.

II

Buying Policy. The Raw Cotton Commission bought in a number of ways, either inherited from its predecessor, the Cotton Control, or developed in the course of its operations. With certain colonies, namely Nigeria, Nyasaland and Aden, it made long-term bulk purchase agreements, but these accounted for only a small proportion of annual imports. With other members of the Sterling Area it had bulk purchase agreements which took up a varying proportion of the producing country's exportable surplus, but did not commit it for more than one season. Purchases of non-sterling cotton other than Egyptian were made indirectly through foreign shippers'

[1] The writer is much indebted to Sir Ralph Lacey, K.B.E., and to Mr. C. R. Barber, O.B.E., for advice in preparing this paper. The responsibility for the opinions expressed rests with the writer.

agents in Liverpool and Manchester, individual contracts varying considerably in size. Egyptian cotton was imported for most of the Commission's life through its own buying office in Alexandria.

The Commission's buying methods were strongly criticized, especially in the earlier years of its operations. The more reasonable critics admitted that the prices paid for bulk supplies were probably satisfactory, although an accurate appraisal is handicapped for lack of evidence, as it is with bulk-buying of other raw materials. *Prima facie*, there was probably something to be said for bulk-buying by a central importing agency which had to negotiate with organized sellers in the exporting countries, particularly when other importing countries were offering bulk contracts. As a strong critic of the Commission admitted in 1949, the Liverpool merchants were 'no nearer than in 1946 to definite proposals about how private trading would work . . . with the habits of bulk-selling'.[1] In certain foreign markets, for example Egypt and Argentina, the Commission was probably in a position to offset the weight of organized sellers, although it might have had a stronger bargaining position if the Treasury had given it more financial scope in its import programmes.

Critics tended to overlook an advantage of bulk purchases and advance commitments during a period of scarcity, whether this was due to currency difficulties or to a physical shortage of cotton. When there was intense competition from other public buying agencies, such as those of east European countries, the Commission ran the risk of getting less cotton than it thought it needed to fulfil its obligations to the industry. In so far as it was desirable to be on the safe side, bulk-buying and advance commitments could be looked upon as a guarantee of obtaining a minimum quantity of a particular growth. It is possible, too, as one critic admitted, that the Commission's long-term contracts assisted growers in those areas which still needed the encouragement of an assured outlet for at least part of their output.[2] This may have been true of Nigeria, imports from which were much greater than before the war. It seems also that the Commission's policy played an important part in opening up new sources of supply by means of its Miscellaneous Growths Buying Branch, for example, in Cyprus and Aden.

It was a general complaint initially that spinners could not rely on continuity of supply of certain growths which were wanted for the production of high quality yarn. Some spinners never abandoned the view that 'a centralized buying agency could not provide that

[1] *Manchester Guardian Survey*, 'The Government and the Cotton Trade', February 1949, p. 21.
[2] *Manchester Guardian*, November 13th, 1953, 'Trade Notes'.

tradition of personal contact with overseas shippers which was essential to secure exact quality shipments'. At first, the Commission seems to have made mistakes in estimating correctly the quantities of particular growths required for future consumption. The validity of the criticism was implied in the major reforms of the Commission's organization early in 1949. One of these reforms involved the appointment of 'salesmen for each growth who [were] to go to the mills to find out precisely what the spinners wanted, to collect market information, and to ensure that as far as humanly possible the spinners' needs were met'.[4] This was clearly a necessary element in the planning of imports, particularly in view of the need to supply high quality yarn for exporters of finished textiles. The delay in making these organizational changes temporarily worsened the Commission's standing even with those not ill-disposed towards it.

In its defence, the Commission stressed the obstacles beyond its control which prevented every spinner receiving exactly the growth of cotton when and in what quantities he wanted. An examination of these obstacles suggests that neither manufacturers nor merchants fully appreciated the difficulties under which the import of raw cotton had to be carried out, especially between 1948 and 1951. As the chairman pointed out, purchases were hampered 'not only by our own national exchange difficulties but by control of exports in virtually all the major cotton-growing countries, both as regards quality and quantity'.[5] No evaluation of the experiment is reasonable which fails to make allowance for these obstacles.

For a large proportion of its purchases the Commission was impeded by Treasury restrictions. Imports of raw cotton were particularly liable to restrictions because they formed the largest single item in our dollar expenditure. The Commission's intended purchases each season were closely scrutinized and eventually fixed in relation to the government's estimate of the country's dollar position and not in relation to what the Commission estimated the trade would choose to buy. The result of the strict regulation to which cotton imports were subject was a sharp drop in our consumption of American cotton compared with pre-war years and compared with experience in other importing countries, as Table I shows. The increase in the proportion of American cotton consumed by Germany and Japan is probably explicable in terms of their extremely close economic links with the United States during the post-war period. So far as the other countries are concerned, the expenditure of dollars on raw

[4] *Manchester Guardian Survey*, 'The Government and the Cotton Trade', p. 24. Extract from statement by General Sales Manager of the Commission.
[5] Ibid., p. 26.

cotton was probably treated more leniently than in Britain. The Treasury restrictions applied not only to purchases of American cotton. Imports from other countries producing similar cotton were also impeded by dollar controls, since payment in dollars was frequently stipulated by the government of the selling country.

TABLE I

MILL CONSUMPTION OF U.S. COTTON. PER CENT OF TOTAL CONSUMPTION

Country	*1927-32*	*1933-37*	*1947-50*
U.K.	57	43	26
Germany	74	41	71
France	66	57	55
Italy	71	63	59
Belgium	49	46	38
Japan	48	44	74

Whether it was wise to place such a severe handicap on the Commission and its Lancashire customers in this way is open to doubt. The strictness of dollar controls has frequently been taken as a measure of sound economic policy. It is perhaps not as self-evident as it may appear superficially. If dollar supplies are cheaper or more suitable than soft-currency supplies of a commodity, particularly for exports to hard currency countries, too harsh restrictions on the former may impose a handicap on the export of manufactures which use them. The Treasury's strict rationing of the Commission's dollars forced it, in order to fulfil its statutory obligation to the industry, to buy alternative growths not on their merits to the spinners but simply because they could be paid for in sterling. This involved the purchase of cotton for sterling often at much higher prices than dollar cotton, since the competition for the former was artificially strengthened by the dollar shortage.

As the Commission pointed out repeatedly in answer to spinners' complaints, the relative import prices of different types of raw cotton did not reflect, as it had done before the war, their relative merits from the point of view of manufacturers. Instead, they were very much influenced by the relative demand for hard and soft currencies. Importing countries which wished to buy non-dollar cotton were required to pay a premium to sellers who were prepared to accept soft currency. This premium varied according to the supply position of non-dollar cotton and the intensity of the dollar shortage. It was at its highest during the 1950-51 boom. With the improvement in the dollar position and the slump in the cotton manufacturing industry in 1952, the prices of non-dollar cotton fell sharply to more normal levels, as Table II indicates.

Both the Commission and its customers maintained that Lancashire's competitive position in some overseas countries was weakened by the use of unsuitable cotton or of cotton at relatively

high prices. Whether it was as important a handicap as was made out is difficult to say. That it did hamper exports to some extent seems a reasonable assumption. It may have been a factor in checking the growth of exports to Canada, where post-war American competition has been particularly successful. But these disadvantages

TABLE II

RAW COTTON PRICES IN EXPORTING COUNTRIES. $ PER 100 LB.

	1938	*1948*	*1949*	*1950*	*1951*	*1952*	*1953*
U.S.A.	9.0	33.8	32.2	36.2	41.6	38.7	32.9
Egypt (a)*	11.4	58.9	44.6	59.8	74.6	47.5	36.1
(b)	—	79.5	70.1	57.1	100.0	67.7	44.2
Pakistan	—	40.2	39.9	40.7	66.7	46.8	33.4
Brazil	8.4	30.6	33.0	41.0	58.6	47.6	37.9

Source: International Financial Statistics. * (a) Ashmouni cotton; (b) Karnak cotton.

have not existed uniformly since the war. One is tempted, therefore, to attach greater importance to the recently expressed view that the Lancashire industry tended to be indifferent to the export drive, at least as far as the more difficult markets were concerned.* In extenuation it might be pleaded that raw material difficulties created a sense of frustration which reacted on the export of high quality textiles in varying degrees up to 1952. Thereafter it is more difficult to find excuses.

Even if the Commission had been allowed a much freer hand by the Treasury, its ability to buy where and what it wanted would have been limited by government policies in the exporting countries. The extent to which freedom in the world market for raw cotton was affected by government policies was underestimated by critics of the Commission. Interference was much more extensive and its distorting effects on prices much worse than before the war. Both India and Pakistan imposed controls on exports of raw cotton after the political settlement with Britain. Certain types of Indian cotton were subject to an export embargo for most of the Commission's life. Cotton which was not covered by the ban was sometimes obtainable only for hard currency, although the Commission was able to exchange Sudan for Indian cotton with the agreement of the Indian government. Difficulties arose in importing from Pakistan because of licensing procedures and government interference with the acreage devoted to certain growths. Export duties of varying size were levied by both countries.

The Egyptian market was probably the most difficult for importers, even if we exclude the effects of harmful speculation. It seems to have been subject to every type of government control familiar in cotton-producing countries, including export taxes, price supports,

* Cf. B. Vitkovitch, 'The Decline of Cotton', *Manchester Guardian*, July 26th, 1955. See also his 'The U.K. Cotton Industry, 1937-54', *Journal of Industrial Economics*, July 1955.

controls over production and conditional sales, that is, sales only against dollars.

Problems arose in importing American cotton, quite apart from those created by the Treasury's dollar policy. In the 1950-51 season when there was an abnormally short American crop, the Commission's permitted expenditure on American cotton, paradoxically, was greater than the amount it could spend on imports. The supply of American cotton surplus to domestic needs was rationed between importing countries in a manner unfavourable to Britain. The British allocation was both much less than the Commission could afford and also less than the amount allocated to Germany, Japan and Italy. The Commission's bitterness was sharpened by the fact that American prices were, even by post-war standards, abnormally low compared with the prices of comparable American-type and Egyptian-type cotton.[7] Another illustration of the way in which the Commission's purchases were complicated can be found in the use of Marshall Aid funds. When the E.C.A. made its quarterly allocations of dollars for the purchase of American cotton, each receiving country was required to take a fixed percentage of low-grade cotton, whether or not it was needed. Presumably this condition was imposed with the object of keeping down the Commodity Credit Corporation's stocks of low-grade cotton. The second difficulty arose from the fact that the spending of the quarterly dollar allocation from the E.C.A. had to be concentrated in the (usually) short time between the date of the so-called 'procurement authorization' and the end of the quarter. According to the Commission, this forced it 'to buy within narrow time limits in a market forewarned of its intentions, to the inconvenience of shippers and in part to the detriment of the quality of shipments'.[8]

When these problems are taken into account, the outside observer can hardly avoid the impression that much violent criticism was misguided. There is, however, one aspect of the Commission's buying policy which escaped criticism by the industry and which in retrospect deserves analysis because of its bearing on the discussion preceding the 1953 Cotton Act. This is the size of the stocks which the Commission considered it necessary to hold.

The Commission stated its case in these terms, 'a body charged like the Commission with a responsibility to enable the industry to continue in production cannot be wholly guided by purely commercial considerations when considering the desirability of purchasing

[7] The two main types of cotton may be described as American-type and Egyptian-type. Each covers a number of growths from various sources, these growths being substitutes in varying degrees for American and Egyptian cotton.

[8] Raw Cotton Commission *Annual Report* for year ended July 31st, 1949, p. 7.

cotton; the disappearance of free exchanges almost throughout the world has made the acquisition of a long interest in cotton to some degree a gamble, and ordinary commercial prudence would preclude the building up of a stock of any magnitude. But it is generally considered that a stock must be maintained in this country if the Lancashire industry is to be economically and competitively carried on'.[1] It is interesting to compare the Commission's stocks at various dates with those held in other European countries. Table III shows the situation in one pre-war year and five post-war years.

TABLE III

END-YEAR STOCKS AS PERCENTAGE OF MILL CONSUMPTION

Country	*1937-38*	*1947-48*	*1948-49*	*1949-50*	*1950-51*	*1951-52*
United Kingdom	57	80	80	67	58	73
Germany	42	56	29	33	18	16
France	52	24	30	43	24	23
Belgium	33	28	24	35	22	29
Italy	31	44	37	42	40	45

Source: Commonwealth Economic Committee.

The comparison with Germany, France and Belgium shows that the British ratio of stocks to mill consumption was much the largest, the difference in post-war years being considerably greater than in the pre-war year. It may be wondered why the Continental cotton industries, which seem to be at least as efficiently run as the Lancashire industry, should have flourished on a much smaller stock of raw cotton.

There seem to be several reasons for the contrast. First, the Lancashire industry normally uses a wider range of cotton than the Continental industries. This would naturally lead to larger stocks in Britain under any system of buying, public or private, but would account for only part of the difference in stock-consumption ratios, and probably a small part. Second, the very marked contrast in 1951, which was a crucial year in which to hold large stocks, can be explained partly by the effects of the American rationing scheme in the 1950-51 season. As already noted, the Commission's allocation was unsatisfactory. In order to cope with the anticipated shortage the Commission bought a variety of outside growths at extremely high prices. This it was able to do only because it had a long purse. When world prices fell in 1951, under the influence of expectations of a large American crop and an improved dollar situation, the demand for the expensive outside growths also fell and the Commission could only sell them well below original cost. Third, and closely linked to the preceding point, is the Commission's behaviour as the sole supplier to the Lancashire industry. The view was held that policy

[1] Raw Cotton Commission *Annual Report* for year ended July 31st, 1953, p. 23.

regarding stocks had to be guided by the fact that spinners had no alternative sources of supply. Although spinners, motivated solely by considerations of self-interest, could buy or not buy as they pleased, the Commission apparently felt that it should not take the risk of reducing its stocks greatly, although world prices were abnormally and precariously high. The 'safety first' policy based on this monopoly conscience argument may have been overdone. It may have gone too far in playing safe, since maintaining adequate supplies to the industry meant exposure to a long position which it could not hedge.

It is evident that the Commission accepted obligations which private enterprise could not and would not have accepted. The best example of this type of behaviour appears to be the exceptionally large commitment to buy Sudan cotton in the 1951-52 season. According to the Commission, stocks of Sudan cotton in the autumn of 1951 were thought to be big enough to preclude purchases in excess of those made in previous years. Uncertainty in political relations with Egypt, however, raised the possibility of an Egyptian embargo on exports to Britain. Fearing the temporary loss of high-grade Egyptian cotton and not foreseeing the textile slump, or at least not foreseeing its magnitude, the Commission bought, at the high prices for non-dollar cotton which still prevailed in the autumn of 1951, about 50 per cent more Sudan cotton than it had bought in the two previous seasons. On both counts the decision proved to be wrong. Whether the slump ought to have been foreseen is a matter of opinion, but even if it had been foreseen there was still the question of the potential embargo. Presumably if a different decision had been taken, and the demand had subsequently exceeded supply, the Commission would have been the target for severe criticism.

III

Sales Policy. One of the arguments in defence of the 1947 Act was that a centralized buying agency could give the industry greater stability in the price of its raw material than could be guaranteed by a private market. The performance of the Commission in this respect was inevitably a focus of attention throughout its controversial career. After a period of hesitation the Commission chose to base its selling prices approximately on current replacement costs of the main growths. For subsidiary growths for which there was no continuous market, notional prices were used which were related to the prices of the main growths for which they were in varying degrees substitutes.

In practice, the Commission's selling prices were not changed as frequently as replacement costs. Day-to-day price movements in the

exporting countries were ignored if they were thought to be due to forces, commercial or non-commercial, which had only a transient influence. If particularly well-timed deals were made, selling price changes were delayed in order to pass on the benefit to users. In the 1949-50 season, for example, this happened for a time in the case of Egyptian Ashmouni cotton. It is apparent from its first report that the Commission started at least with an attempt to insulate its customers from the extreme variations of the Alexandria market. Charts of its price changes and those of Alexandria show that from January to May 1948 selling prices were also well below replacement costs. In March 1948 Karnak and Ashmouni cotton were sold at only two-thirds of Alexandria prices. In general, however, price changes were sufficiently frequent to dispel any impression of stability, except in a very limited sense, as Table IV shows. Further,

TABLE IV

NUMBER OF CHANGES IN R.C.C. SELLING PRICES

	1948-49	*1949-50*	*1950-51*	*1951-52*
American	6	13	11	18
Ashmouni	10	13	15	22
Karnak	13	7	14	23

some price changes were much sharper than the industry had ever experienced. This led to nostalgia for the much more numerous but smaller price changes of a free market as the consensus of opinion responded quickly to actual and anticipated changes in supply-demand conditions. It is difficult to see where the balance of advantage lies. Since the Commission's selling prices lagged to some extent behind foreign prices, spinners were at a disadvantage when the latter were falling, although at an advantage when they were rising. A much more important disadvantage arose from the fact that the dollar shortage forced Lancashire users to take much less of the relatively cheap dollar cotton than they wanted, but the responsibility for this cannot be laid at the Commission's door.

It is true of course that large changes in raw cotton prices are disconcerting to an industry in the costs of which the raw material plays an exceptionally important part. The Commission's policy probably tended to accentuate this effect, although it is difficult to believe that the contrast with private trading would have been very great when prices were fluctuating violently in foreign markets. Fundamentally, the industry, or at least an important part of it, was sceptical of price-fixing by two or three members of a monopoly public corporation. This seems to underlie much of the criticism of the Commission's price policy. The Cotton Import Committee argued that the burden of responsibility was too great for these members since 'their

decisions affected the well-being of the whole industry.'[10] The implication seems to be that a price arrived at by a free market was to be regarded as 'right' or at least more in accordance with supply-demand conditions than the price fixed by the Commission.

An important modification of the replacement cost selling policy arose from the effect of the dollar shortage on the relative prices of American-type cotton from hard and soft currency countries. As already pointed out, there was a marked tendency at times to bid up the prices of soft currency American-type cotton. Further, the Commission had difficulty in paying for as much hard currency cotton as it wanted, so that it could not escape joining in the scramble for soft currency cotton. Instead of selling each American-type cotton at its own replacement cost, the Commission fixed an 'averaged' replacement cost determined by combining the replacement costs of all the comparable growths in its stock. If it had not done this, the relative scarcity of the cheaper American cotton would probably have made rationing necessary. The result of this policy, as the Cotton Import Committee pointed out, although without disapproval, was that 'spinners were obliged to buy a growth of cotton at a price determined not by the relation of their demand to available supplies of that cotton, but by the proportion of "cheap" dollar cotton and "expensive" outside growths in the import programme determined by government departments at the opening of each season'.[11] Thus dollar cotton cost the spinner more than the Commission paid for it, but non-dollar cotton of the American-type cost less.

In practice, the 'averaged' price tended to be much closer to the lower American price than to the import prices of the outside growths. In November 1951, for example, the replacement prices of Brazilian, East African and American cotton were 64d., 57d. and 40d. per pound respectively. The Commission's selling price for the group was about 45d. per pound. In the circumstances it was probably the most practicable way of compensating for the shortage of American cotton. If imports had been bought privately a similar policy would have been necessary, as happened in several Continental countries where spinners received import licences for cotton produced in hard currency countries. If a manufacturer had to buy several American-type growths, he simply averaged their different prices in fixing the selling price of his cloth or yarn.

So far as the abnormal price differentials between Egyptian and American cotton are concerned, it might have been worth while from the national point of view to sell Egyptian cotton at a loss,

[10] *Report of Cotton Import Committee*, 1952, p. 12.
[11] Ibid., p. 10.

since its end-products could normally find a ready sale in dollar and other hard currency markets, and to offset the loss by higher prices for certain growths the end-products of which were sold in less competitive markets. It would have been consistent with the export drive to do this, since the export prices of cloth based on the existing price differentials for raw cotton were so great at times that buyers in hard currency countries tended to switch to producers who had free access to the cheaper dollar cotton, although with a more normal differential they would have preferred the products of Egyptian cotton. It is possible that the gains in hard currency markets would have more than offset losses in other markets. The Commission did not attempt a policy of this kind.[11] It did try price discrimination to some extent by using the price mechanism to encourage or discourage the use of certain cottons, but not with an eye to the export trade as suggested here. The object was to eke out scarce supplies or to switch demand to growths of which there was no shortage.

IV

Let us consider now the bearing of sales policy on the Commission's losses. The result of basing selling prices on replacement costs should have been that profits were made in periods of rising prices and losses in periods of falling prices. The bigger the stocks the bigger should have been profits and losses. Much was made in the 1953 parliamentary debate of the loss of public money as a reason for the state's withdrawing from cotton importing, since the original assumption had been that over a period of good and bad years the Commission would break even. The question arises why losses exceeded profits by such a large sum. The annual profit or loss during the Commission's lifetime is shown in Table V. Up to the

TABLE V

NET ANNUAL PROFIT OR LOSS ON TRADING AND COVER OPERATIONS. £M.

1948 Jan.-July	*1948-49*	*1949-50*	*1950-51*	*1951-52*	*1952-53*	*1953-54*
+1	−0.7	+10	−0.1	−25.0	−22.4	+3.8

end of the 1949-50 financial year a net profit on all operations of about £10mn. had been made. Most of that profit, however, was due to the windfall gain from devaluation, since selling prices were raised almost immediately after devaluation. If this gain is excluded, the Commission had probably not done more than break even. The catastrophe occurred in the next three seasons. Although large profits were made in the Korean raw materials boom, the net result

[11] It has been pointed out to the writer that the Commission would have acted as suggested above only at the request of the Board of Trade.

for the year was a small deficit. This was due to trading losses as prices declined from their peak early in 1951 and to the valuation of stocks by reference to forward discounts, which meant at substantially less than original cost. Prices continued to fall in 1952 and 1953, and the abnormal differential between dollar and non-dollar cotton was greatly reduced. The Commission then paid the penalty for taking the risk of holding large unhedged stocks. Both the reserve fund and the accumulated surplus were swallowed up by the resulting losses. At the end of the 1952-53 season there was a cumulative net loss of about £37mn., although prices were still well above their level when the Commission took over from the Cotton Control. One might have expected a larger surplus in the earlier years. Yet even with the devaluation windfall gain, only £10mn. was made during the 1948-50 period when prices rose by between 50 per cent and 150 per cent. Since the Commission had started off with a stock amounting to about 90 per cent of mill consumption in 1946-47, one would have expected a substantial profit in the first financial year. The reason seems to have been that much was sold below replacement costs. The opportunity was missed of considerably supplementing the reserve fund. It is possible too that the reserve which was inherited from the Cotton Control was smaller than it should have been because price increases were delayed.[13] If these assumptions are correct, the Commission could have at least broken even during its period of monopoly operations.

The question arises why selling prices were not raised when the opportunity existed. One explanation is that the Commission hesitated to do so to the fullest extent because it did not wish to appear to abuse its monopoly power. This is the 'monopoly conscience' argument again. It is apparent that it conflicted with the financial requirements of the 1947 Act. If these were to be regarded as ultimately paramount, the Commission would have had to follow strictly the replacement price formula. Whether it should have done so is presumably a matter of opinion. Certainly as long as its buying and sales policies were affected by non-commercial considerations the Commission laid itself open to losses. No doubt the Korean boom and collapse made things worse than they would otherwise have been, but it is still likely that over a much longer period it would have failed to break even. If this were not the government's intention, then either the 1947 Act would have had to be modified, or else some method would have been needed whereby the industry could have been charged for the cost of the non-commercial risk to which the Commission exposed itself.

[13] Raw Cotton Commission *Annual Report* for half-year ended July 31st, 1948, p. 17.

V

Cover Policy. It is not proposed in this paper to go into the details of the cover schemes which the Commission adopted to protect manufacturers and merchants against price fluctuations.[14] They were, however, a vital part of its work. The provision of hedging facilities was the *raison d'être* of the pre-war Cotton Futures Market. In general, all interested parties had some degree of protection against losses from fluctuations in the price of raw cotton. Most of the spinning side of the industry required such protection, the spinning margin being so small in relation to the cost of the raw material that even small changes in raw cotton prices during the production period of yarn could have a drastic effect on profits.

The 1947 Act authorized the Commission to provide a substitute for the Futures Market. At first, it continued with the system which the Cotton Control had adapted to post-war circumstances, but only against mounting criticism. Briefly, the main weaknesses were these: first, the existing scheme was limited to spinners; second, the Commission did not enter into deferred contracts, i.e. it would sell cotton only for immediate delivery, whereas the manufacturer in planning production wanted to be sure of appropriate supplies in the future; third, there were possibilities of abuse; fourth, the scheme was administratively cumbersome. The absence of deferred contracts was a serious deficiency, since it hampered the Commission in forecasting its customers' needs and must have been responsible to some extent for the failure to supply the right kind of cotton in 1948. Against this criticism, too, there was a defence, namely that the Commission could not be sure of its ability to get the cotton promised for future delivery for the reasons described earlier in this paper. Whether flexible contracts could have been evolved to get round this difficulty is a matter of opinion.

After protracted negotiations with various groups the Commission gradually reformed its cover facilities. Spinners got alternative forms of protection, including contracts for deferred delivery; converters, weavers, doublers and the vertical combines were also catered for by separate schemes. The result was a system which was probably superior to anything available to most European cotton industries and superior also, in the opinion of a number of authorities, to the hedging facilities of the pre-war market. The Commission succeeded in adapting its system of cover very closely to the industry's requirements by providing protection not only against changes in the prices of many different growths but also against changes in the

[14] For a full account of the Commission's cover schemes see C. R. Barber, 'Marketing Processes' in *Manual of Cotton Spinning*, vol. I, The Textile Institute, 1954.

different qualities of these growths. This went beyond the pre-war custom. Effective hedging facilities before the war were available only for American and Egyptian cotton. This tended to check the use by Lancashire of colonial cotton, although, as the Empire Cotton Growing Corporation pointed out, colonial cotton was not inferior to American cotton.[15]

The Commission's cover scheme may in fact have been too good. It has been argued that spinners and their customers were brought to the confident belief that they could avoid the risks involved in buying cotton and yet rely on the material always being available in Lancashire to take off the shelf in penny numbers. In the absence of the Commission, which bore the risk of carrying a large and varied stock, they would have had, as now, to choose between an adverse movement of prices after buying and inability to buy what they wanted when supplies were urgently needed. If in fact this is a reasonable argument, it is probably a point in favour of letting the industry work out its own salvation in buying its raw material and protecting itself against price fluctuations in post-war conditions.

VI

Conclusion. In retrospect, it seems a fair judgment on the Raw Cotton Commission that it was 'more sinned against than sinning'. In spite of handicaps it performed services to the industry which in some respects at least were as good as and sometimes better than those which could have been expected from private trading.[16] Nevertheless some spinners were never reconciled to state trading, largely for the reasons mentioned earlier in this paper, but probably to some extent because of prejudice. Whether they were justified in their persistent criticism of the Commission and in their expectations from private trading is open to doubt. One may question also the force of the merchants' complaint about the loss of the re-export trade and of any foreign business that might have been attracted to the Futures Market. The Commission might have tried to expand re-exports, as it was permitted by the 1947 Act. Certainly they were negligible during its lifetime.[17] But even if it had tried to do so, it is extremely doubtful if it would have had much success. As a recent Board of Trade study has pointed out, there are both political and

[15] Statement by Chairman of Empire Cotton Growing Corporation, quoted in Parliamentary Debate, November 18th, 1953, *Hansard, House of Commons*, vol. 520, col. 1771.

[16] The work of the Commission's research laboratory was particularly useful to the industry. See *Annual Report* for year ended August 31st, 1954, pp. 18-19.

[17] Re-exports amounted on average to 1 per cent of imports during the period 1947-51. Before the war they fell from 8 per cent in the period 1921-25 to only 4 per cent in the period 1933-37. Immediately before the First World War they had amounted to 12 per cent of raw cotton imports.

economic forces operating against a revival of the re-export trade, at least to anything like its former significance.[18]

So far as the role of the Futures Market is concerned, it seems unlikely that it can recover the influence it once exercised on the world market. The decline in the Lancashire industry and in the volume of transactions passing through the Futures Market, and also the persistence of government intervention in the leading cotton-producing countries, are against it. It seems unjustifiably optimistic to expect the withdrawal of government intervention in these countries. Unless there is a considerable change in this respect, the present difficulties of the Futures Market are likely to persist. It should be fully realized that the effective working of the pre-war system depended on circumstances which are either non-existent or unstable at the present time. The basic conditions were that the market should operate in an environment free from arbitrary interference by governments and that the major trading currencies should be free. Only if these conditions were satisfied could it be true that 'prices would be determined by known facts and reasonably predictable prospects, and, therefore, there could be confidence that the normal interaction of supply and demand would continue to govern the movement of values'.[19] The uncertainty created by American policy is an obvious handicap to a free market, but this is only one, although perhaps the major, uncertainty resulting from government interference. This uncertainty, which cannot be assessed as a normal commercial risk, will overhang the cotton market as long as export subsidies are permissible by American legislation.

As the industry contracts and becomes concentrated in large combines probably catering mainly for the home market, the merchant may become simply the agent or buying specialist for the combines, somewhat analogous to the buyer for the large department store. This was tending to happen before the war. As a pre-war study suggested, 'the Liverpool Exchange may tend to become less of a commodity exchange and more of a central purchasing agency'.[20] The large combines then may tend to dispense with hedging and to spread losses from changes in raw cotton prices over the whole range

[18] *Board of Trade Journal*, April 3rd, 1954, pp. 690-3. This appears to be the most authoritative analysis of trends in the re-export trade at present available. It is emphasized that the last fifty years 'have seen the gradual whittling away of the advantages on which the international commodity markets of the United Kingdom were built up', and also a 'steady growth in the relative advantages of markets in the producing countries in relation to United Kingdom markets'. The relative decline in the pull exercised by the British home market, improvement in communications, the disruption of normal trade channels as a result of wars and widespread political action have destroyed British predominance in this field. The study is sceptical about the future of the commodity markets even if political factors should operate less strongly than in the immediate past.

[19] *Manchester Guardian*, April 28th, 1954, article on Raw Cotton Commission.

of their output. Provided their purchases of raw cotton could be regulated on occasions of acute balance of payments difficulties, the state could leave them to organize their own system of buying. They might do no better than the Commission, but at least they would be treated no differently than users of other imported raw materials.

Finally, as a postscript, the question arises whether a mixed system could have existed on a permanent basis. The Cotton Import Committee took the view that the monopoly could be relaxed without disadvantage, but did not express an opinion about the permanence of a mixed system. It became apparent, however, after two seasons, that the fall in the Commission's share of imports to only 44 per cent created serious problems, which affected its ability to give the same service as before to those who opted to remain with it. Stock-holding became riskier for the Commission than before, because with spinners' freedom to contract out, it was difficult to determine the appropriate level and composition of stocks. Long-term contracts were ruled out by the uncertainty about the proportion of contractors-in. There were also personnel difficulties arising from the Commission's insecurity.

To some extent the fall in the Commission's share of the trade must have been affected by the fact that contractors-out could still hedge with it, pending the reopening of the Liverpool Futures Market. One may wonder what would have happened if, after the reopening of the Market, the Commission had still functioned fully and spinners had had the straightforward choice of buying from and hedging with the Commission or doing the same privately. Perhaps it would have been possible to arrive at a workable division between the private and the public sectors. But it would surely have been necessary to require contractors-in to 'sign on' with the Commission for a fairly lengthy period to justify long-term contracts, and also to remove one of the uncertainties of holding a large ready stock of cotton. Whether it would have been desirable to retain the Commission on this basis, i.e. partial nationalization, depends on one's view of the extent to which the government should help contractors-in, particularly the small firms, and the colonial producers.

UNIVERSITY OF LIVERPOOL

[10] P.E.P. *The Cotton Industry*, 1934, p. 48.

PUBLICATIONS RECEIVED

Beyond Nationalization, The Labour Problems of British Coal, by George S. Baldwin, Harvard University Press, London, Cumberlege, 1955, 35s.

Capital and Its Structure, by L. M. Lachman, The London School of Economics and Political Science, G. Bell & Sons, Ltd., London, 1956, 15s.

Cost Reduction, The Institute of Cost and Works Accountants Ltd., London, Gee & Co., 1956, 6s.

Experience Under Railway Labour Legislation, by Leonard A. Lecht, Columbia University Press, London, Cumberlege, 1956, 34s.

The First Three Years of the Schuman Plan, by Derek Curtis Bok, International Finance Section, Dept. of Economics and Sociology, Princeton, New Jersey, 1955.

Graduate Training for Business Management in Great Britain, Europe and North America, Report by C. S. Richards, National Council for Social Research, Union of S. Africa, 1954.

The Labour Government and British Industry, 1945-51, by A. A. Rogow and P. Shore, Basil Blackwell, Oxford, 1955, 18s.

Labor's Wage Policies in the Twentieth Century, by James S. Youtsler, Twayne Publishers, New York, 1956, $5.00.

New Developments in Industrial Leadership, A Comparative Study in Four Countries with an introduction by Sir Walter Puckey and Sir Geoffrey Vickers, Department of Management Studies, The Polytechnic, Regent Street, London, W.1., 1956, 5s.

Production Control and Related Works Statistics, Joint Committee of the Institute of Cost and Works Accountants and the Institution of Production Engineers, Gee & Co., 1956, 5s.

The Rise of the National Trade Union, by Lloyd Ulman, Harvard University Press, London, Cumberlege, 1956, 76s.

Some problems of Incentives and Labour Productivity in Soviet Industry, by G. R. Barker, Faculty of Commerce and Social Science, University of Birmingham, Basil Blackwell, Oxford, 1956, 14s.

Stahl und Staat, by D. Goldschmidt, Ring-Verlag, Stuttgart, 1956.

Taxation of Bonus Shares, The Association of Indian Trade and Industry, Bombay, 1955.

Materials Handling and Work Study Data, Notes from the College of Production Technology, Charing, Ashford, Kent.

The Accountability of Public Companies and *The Accountability of Government Departments*, Course of Studies Paper, The Administrative Staff College, Henley-on-Thames.

Aggiornamenti Sociali, Rivisti Mensile a Schede, Centro Studi Sociali, Milano, 7th year, No. 1, January 1956.

The American Economic Review, Vol. XLVI, No. 1, March 1956.

Bulletin of the Banque de Bruxelles, Economic Research Department, January and April 1956.

Bulletin Bimestriel, Societe Belge d'Etudes et d'Expansion, No. 169, January-February 1956, No. 170, March-April 1956.

Bulletin from the European Community for Coal and Steel, Vol. III, No. 2, December 1955, No. 3, January 1956.

Bulletin of the University of Illinois, Vol. 53, No. 43, February 1956.